United States
Department of
Agriculture

Research and
Education Committee

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1985 Annual Report on the Food and Agricultural Sciences

From the Secretary of Agriculture to the President and the Congress of the United States

PREFACE

This report was prepared under the auspices of the USDA Research and Education Committee, which was established in 1981 as a unit of the Secretary of Agriculture's Policy and Coordination Council. The Assistant Secretary of Agriculture for Science and Education serves as chairperson of the Committee.

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FEDERAL, STATE, AND PRIVATE INDUSTRY SUPPORT FOR THE FOOD AND AGRICULTURAL SCIENCES

DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture's research and education (R&E) agencies supported food and agriculture research, extension, and teaching programs funded at approximately $1,334 million in FY 1985, up 7.8 percent from FY 1984. These programs were centered in the Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), National Agricultural Library (NAL), Forest Service (FS), and Economic Research Service (ERS). Other agencies having research and education activities include the Agricultural Cooperative Service (ACS), Agricultural Marketing Service (AMS), Human Nutrition Information Service (HNIS), Office of International Cooperation and Development (OICD), Office of Transportation (OT), Statistical Reporting Service (SRS), and Federal Grain Inspection Service (FGIS). USDA research and education program funding for fiscal year 1986 is estimated to be $1,283 million (table 1).

The research and education (R&E) programs of the Department are complementary and mutually supportive in providing new knowledge, technology, and information on food, agriculture, and forestry issues vital to producers, marketing firms, consumers, and action agencies. The results of these efforts affect the total economy of the United States and millions of consumers here and abroad. Including input supply production, processing, and marketing, the agriculture and forestry sectors account for more than 20 percent of gross national product of employment in the United States. These sectors also provided $11.4 billion in export trade surpluses in FY 1985. This helped to offset huge and increasing trade deficits in other categories. At nome the cost of food to consumers as a share of disposable income continues to decline. In 1985 food required only about 15 percent of U.S. consumers' disposable income, down from 17 percent in 1975.

USDA research programs address national issues in production efficiency, export markets, marketing efficiency, natural resources management and conservation, human and community development, and human nutrition. Research programs financed by the Department, encompassing this complex array of issues, represented less than 2.0 percent of the $49.5 billion obligated for Federal research in FY 1985.

The Secretary of Agriculture has identified research and extension as one of his five major goals. The research and education programs provide major underpinnings for the remaining goals of the Secretary that are (1) a strong, healthy agricultural economy, (2) food and fiber for peace and economic

stability, (3) resource conservation, and (4) support for State and local governments.

Over the past 8 years, funding for USDA Research and Education programs has grown significantly in current dollars from $888 million in FY 1978 to $1,283 million for FY 1986 (table 1 and fig. 1). However, the gain in current dollars for research and education was more than offset by inflation over the period. In constant 1978 dollars, funding actually declined from $888 million in FY 1978 to $766 million in FY 1986 (table 2).

The trend in overall R&E funding in constant dollars over the FY 1978-86 period has trended downward and in FY 1986 was 13.7 percent below FY 1978. USDA funding for research in constant dollars was highest in 1978, and next highest in 1985. Funding for education in constant dollars declined in all years from 1978 to date (fig. 2).

Differences in funding were apparent among the R&E agencies. Four agencies operating R&E programs over the FY 1978-86 period had funding increases more than sufficient to cover inflation; two maintained a level of funding sufficient to match inflation; and seven did not receive funding increases large enough to cover inflation (table 3).[1]

[1]CSRS received funding increases for research programs; however, the Agency did not receive large enough increases to cover inflation for its educational programs.

Table 1.--U.S. Department of Agriculture: Appropriations for research and education FY 1978-86

Item	Year								
	1978	1979	1980	1981	1982	1983	1984	1985	1986[1/]
RESEARCH	Million dollars								
Agricultural Research Service[2/]	313.9	328.0	358.0	404.1	423.2	451.9	469.0	492.1	480.1
Coop. State Research Service									
Hatch Act Formula	109.1	109.1	118.6	128.6	141.1	147.2	152.3	156.5	148.8
Cooperative Forestry	9.5	9.5	10.0	10.8	12.0	12.4	12.7	13.1	12.4
1890 Colleges & Tuskegee	14.1	16.4	17.8	19.3	21.5	21.8	22.8	23.5	22.3
Special Research Grants	7.2	16.3	15.2	18.2	23.1	27.8	26.5	33.2	29.0
Competitive Reaearch Grants	15.0	15.0	15.5	16.0	16.3	17.0	17.0	46.0	42.3
Rural Development Research	1.5	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Animal Health & Disease	0.0	5.0	6.0	6.5	5.8	5.8	5.8	5.8	5.5
Direct Federal Admin.	1.5	1.5	1.3	1.3	0.8	0.3	0.6	1.5	1.5
Forestry Competitive Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	6.5
Total, CSRS[3/]	157.9	174.3	185.9	200.7	220.6	232.3	237.7	287.4	268.3
Statistical Reporting Service	5.0	5.4	5.0	7.5	7.0	7.6	8.2	8.4	8.1
Economic Research Service	26.0	28.2	26.1	39.5	39.4	38.8	44.3	47.1	44.1
Human Nutrition Info. Service	6.1	6.6	7.1	8.2	8.5	7.7	6.1	7.5	12.9
Agricultural Coop. Service	1.8	2.0	1.6	1.8	1.7	2.2	2.2	2.9	2.8
Agricultural Marketing Service	0.9	1.0	1.3	1.4	1.5	1.5	1.6	1.6	1.5
Office of Transportation	0.6	0.7	0.8	0.9	1.0	0.8	0.8	1.3	1.0
Office of Int. Coop. & Dev.	6.6	6.6	5.3	5.0	0.7	5.5	5.3	5.4	3.4
Forest Service	90.6	95.0	95.9	108.4	112.1	107.7	108.7	113.8	113.6
Federal Grain Inspection Service	0.4	0.4	0.5	0.5	0.6	0.6	0.7	1.1	1.1
Total, Research	609.8	648.2	687.5	778.0	816.3	856.6	884.6	968.6	936.9
EDUCATION									
Extension Service									
Smith-Lever 3(b&c) Formula	176.0	179.8	189.3	205.4	219.4	230.4	235.0	241.5	229.7
Other Extension Programs	75.0	77.5	78.2	80.7	90.0	92.8	93.8	96.8	93.1
Direct Federal Admin.	6.5	6.5	6.5	6.1	6.3	5.4	5.5	5.4	5.2
Total, Extension Service	257.5	263.8	274.0	292.2	315.7	328.6	334.3	343.7	328.0
Coop. State Research Service									
Bankhead-Jones	11.5	11.5	11.5	11.5	0.0	0.0	0.0	0.0	0.0
Morrill-Nelson	2.7	2.7	2.7	2.7	2.8	2.8	2.8	2.8	2.8
Competitive Fellowship Granta	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	2.9
1890 Colleges Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.9
Total, CSRS	14.2	14.2	14.2	14.2	2.8	2.8	7.8	9.8	7.6
National Agricultural Library	6.6	7.0	7.3	8.2	8.2	9.1	10.4	11.5	10.8
Total, Education	278.3	285.0	295.5	314.6	326.7	340.5	352.5	365.0	346.4
TOTAL, Research & Education	888.1	933.2	983.0	1,092.6	1,143.0	1,197.1	1,237.1	1,333.6	1,283.3

1/ Reflects reductions under P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985.

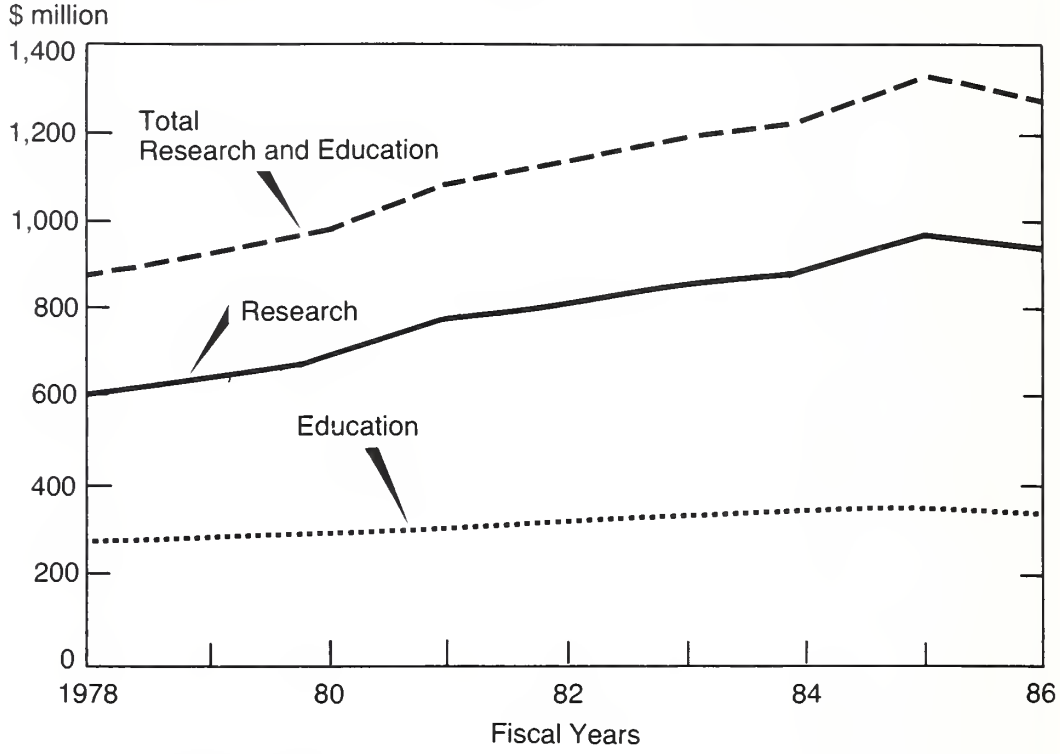
2/ Excludes ARS construction which has been (in million of dollars): $9.0 ('78), $36.7 ('79), $0 ('80), $12.1 ('81), $8.6 ('82), $4.9 ('83), $77.9 ('84), $22.4 ('85), $6.1 ('86).

3/ Excludes 1890 Colleges and Tuskegee Research Facilities which has been $10.0 million annually from FY 83 through FY 85 and $9.9 million in FY 86.

Source: OB&PA-USDA

Figure 1

USDA Appropriations for Research and Education Programs (Current Dollars)



Source—OB & PA, USDA

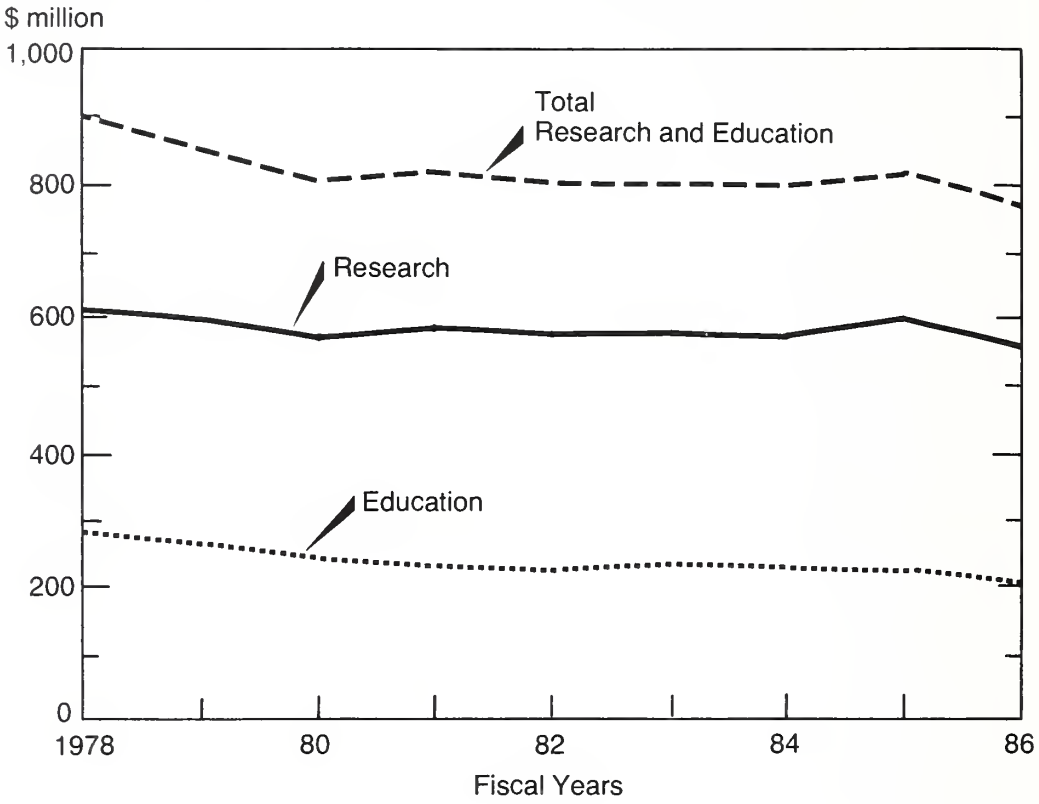
Table 2.--U.S. Department of Agriculture: Appropriations for research and education in constant 1978 dollars, FY 1978-86

Item	Year								
	1978	1979	1980	1981	1982	1983	1984	1985	1986
RESEARCH									
Inflation Rate		9.1%	11.3%	9.2%	7.1%	4.3%	4.5%	4.5%	3.5%
GNP Deflator for Gov't. Purchases Index: (1982=100)	70.4	76.8	85.5	93.4	100.0	104.3	109.0	113.9	117.9
	Million Dollars								
Agricultural Research Service	313.9	300.7	294.8	304.6	297.9	305.0	302.9	304.2	286.7
Coop. State Research Service									
Hatch Act Formula	109.1	100.0	97.7	96.9	99.3	99.4	98.4	96.7	88.9
Cooperative Forestry	9.5	8.7	8.2	8.1	8.4	8.4	8.2	8.1	7.4
1890 Colleges & Tuskegee	14.1	15.0	14.7	14.5	15.1	14.7	14.7	14.5	13.3
Special Research Grants	7.2	14.9	12.5	13.7	16.3	18.8	17.1	20.5	17.3
Competitive Research Grants	15.0	13.8	12.8	12.1	11.5	11.5	11.0	28.4	25.3
Rural Development Research	1.5	1.4	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Animal Health & Disease	0.0	4.6	4.9	4.9	4.1	3.9	3.7	3.6	3.3
Direct Federal Admin.	1.5	1.4	1.1	1.0	0.6	0.2	0.4	0.9	0.9
Forestry Competitive Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	3.9
Total, CSRS	157.9	159.8	153.1	151.3	155.3	156.8	153.5	177.6	160.2
Statistical Reporting Service	5.0	5.0	4.1	5.7	4.9	5.1	5.3	5.2	4.8
Economic Research Service	26.0	25.9	21.5	29.8	27.7	26.2	28.6	29.1	26.3
Human Nutrition Info. Service	6.1	6.0	5.8	6.2	6.0	5.2	3.9	4.6	7.7
Agricultural Coop. Service	1.8	1.8	1.3	1.4	1.2	1.5	1.4	1.8	1.7
Agricultural Marketing Service	0.9	0.9	1.1	1.1	1.1	1.0	1.0	1.0	0.9
Office of Transportation	0.6	0.6	0.7	0.7	0.7	0.5	0.5	0.8	0.6
Office of Int. Coop. & Dev.	6.6	6.0	4.4	3.8	0.5	3.7	3.4	3.3	2.0
Forest Service	90.6	87.1	79.0	81.7	78.9	72.7	70.2	70.3	67.8
Federal Grain Inspection Service	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.7	0.7
Total, Research	609.8	594.2	566.1	586.4	574.7	578.2	571.3	598.7	559.4
EDUCATION									
Extension Service									
Smith-Lever 3(b&c) Formula	176.0	164.8	155.9	154.8	154.5	155.5	151.8	149.3	137.2
Other Extension Programs	75.0	71.0	64.4	60.8	63.4	62.6	60.6	59.8	55.6
Direct Federal Admin.	6.5	6.0	5.4	4.6	4.4	3.6	3.6	3.3	3.1
Total, Extension Service	257.5	241.8	225.6	220.2	222.3	221.8	215.9	212.4	195.9
Coop. State Research Service									
Bankhead-Jones	11.5	10.5	9.5	8.7	0.0	0.0	0.0	0.0	0.0
Morrill-Nelson	2.7	2.5	2.2	2.0	2.0	1.9	1.8	1.7	1.7
Competitive Fellowship Grants	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.1	1.7
1890 Colleges Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.1
Total, CSRS	14.2	13.0	11.7	10.7	2.0	1.9	5.0	6.1	4.5
National Agricultural Library	6.6	6.4	6.0	6.2	5.8	6.1	6.7	7.1	6.4
Total, Education	278.3	261.3	243.3	237.1	230.0	229.8	227.7	225.6	206.8
TOTAL, Research & Education	888.1	855.4	809.4	823.5	804.7	808.0	799.0	824.3	766.3

Source: OB&PA-USDA

Figure 2

USDA Appropriations for Research and Education Programs (Constant Dollars)



Source–OB & PA, USDA

Table 3.--U.S. Department of Agriculture: Percentage changes in appropriations for research and education programs, by Agency, from FY 1978 to 1986 in constant 1978 and current dollars

Agency	Constant 1978 dollars	Current dollars
Research	Percent	Percent
Agricultural Research Service	- 8.7	+ 52.9
Cooperative State Research Service	+ 1.5	+ 69.9
Statistical Reporting Service	- 4.0	+ 62.0
Economic Research Service	+ 1.2	+ 69.6
Human Nutrition Information Service	+26.2	+111.5
Agricultural Cooperative Service	- 5.9	+ 55.6
Agricultural Marketing Service	0	+ 66.7
Office of Transportation	0	+ 66.7
Office of Int'l Cooperation & Dev.	-69.7	- 48.5
Forest Service	-25.2	+ 25.4
Federal Grain Inspection Service	+75.0	+175.0
Total, Research	- 8.3	+ 53.6
Education		
Extension Service	-23.9	+ 27.4
Cooperative State Research Service	-68.3	- 46.5
National Agricultural Library	- 3.0	+ 63.6
Total, Education	-25.7	+ 24.5
Total, USDA Research and Education	-13.7	+ 44.5

STATE AND COUNTY SUPPORT

State and county support for research and extension for the food, fiber, and forestry system at about $1.4 billion per year is slightly higher than that of the Federal contributions of about $1.3 billion. Combined Federal, State, and county funds support approximately 11,000 scientists and 17,000 extension personnel who are the formulators and extenders of knowledge needed by the Nation's largest industry. Public investment in food and agriculture research and education has consistently provided annual returns of 30 percent or more.

State support for the food and agricultural sciences is provided primarily through the land-grant institutions (1862, 1890, forestry schools, and Tuskegee Institute) and includes funds for research, extension, and higher education. However, an estimated 50 State-supported, non-land-grant institutions also have agricultural programs. These programs are primarily devoted to higher education.

PRIVATE INDUSTRY RESEARCH AND DEVELOPMENT

A recent report "A Survey of U.S. Agricultural Research by Private Industry III" published in July 1985 by the Agricultural Research Institute (ARI) of Bethesda, Maryland, stated that "the best estimate of private industry annual expenditures in agricultural research (is) approximately 2.1 billion dollars."

Based upon ARI data, industry apparently is devoting approximately 15 percent of its R&D expenditures to basic research, 43.5 percent to applied research, and 41.5 percent to developmental research.

AGRICULTURAL RESEARCH SERVICE (ARS)

Agricultural Research Service (ARS) conducts mission-oriented research to perpetually ensure an abundance of high-quality, nutritious, reasonably priced food and other agricultural products to meet domestic and world needs while maintaining environmental quality. ARS uses coordinated, interdisciplinary approaches to conduct basic and applied research pertaining to research on soil and water conservation, plant productivity, animal productivity, commodity conversion delivery, human nutrition, and integration of agricultural systems.

Research is conducted at numerous locations in the United States, Puerto Rico, Virgin Islands, and several foreign countries. When appropriate, the research is conducted in cooperation with the State agricultural experiment stations, other State and Federal agencies, and private institutions.

Improved Pesticide Waste Disposal

A major problem faced by the American farmer and commercial pesticide applicators is the safe and effective disposal of pesticide wastes. ARS scientists have been working on a new approach to pesticide waste disposal involving the use of ultraviolet irradiation and ozone to break up the pesticide molecule so that it can be easily metabolized by soil micro-organisms. This new disposal technology has been successfully tested on several widely used pesticides, such as 2,4-D, atrazine, and paraquat.

Water Resources Model Validated

SWRRB (Simulator for Water Resources in Rural Basins), a model developed to predict the impact of alternative management decisions on water and sediment yields, has been validated. Experiments on 11 large watersheds from 8 locations across the Nation showed that the model can realistically simulate water and sediment yields under a wide range of soils, climates, land uses, topographies, and management alternatives. The validation will give consultants, Government agencies, and others who are currently using the model greater confidence in the results they obtain.

Computer Program Reduces Irrigation Costs

ARS scientists have developed an integrated water and energy management software program to reduce center-pivot irrigation costs and to improve water management. The user-friendly software program enables farmers to schedule irrigations and to remotely operate center-pivot systems. Tests of this management system showed that by scheduling irrigations to more closely match crop water requirements energy costs could be reduced approximately $900 per year per center-pivot system.

Yazoo Basin Watershed Protection Program	ARS is cooperating with the Soil Conservation Service and the U.S. Army Corps of Engineers in the development of a watershed protection program for the Yazoo Basin in Mississippi. The six watersheds selected for demonstrating the effectiveness of flood and sediment control measures in the Yazoo Basin are to be equipped with hydraulic structures designed by ARS. Use of these structures is expected to reduce the cost of channel-grade control by 50 to 60 percent.
Pest-Resistant Alfalfa	Estimated annual losses in alfalfa from disease and insect pests amount to about 40 percent of national production. Alfalfa germplasm was released for use by breeders that provides protection against five major diseases (anthracnose, bacterial wilt, downy mildew, fusarium wilt, and phytophthora root rot) and two insects (pea aphid and spotted alfalfa aphid).
Sunflower Hybrid Genetic Base Expanded	Sunflower hybrids are currently being produced from a single source of cytoplasmic male sterility for seed production. The use of this single source limits the genetic base of parental lines and increases the vulnerability of the entire U.S. sunflower crop to diseases. Three new germplasm sources for male sterility have been developed by ARS for use in producing broader based sunflower hybrids for the future.
Improved Cotton Fiber Quality	ARS scientists in South Carolina and Mississippi have developed improved germplasm that combines increased fiber staple length and tensile strength with premium range micronaire values and acceptable yields.
High Protein Soybean Developed	Six breeding lines of soybeans have been developed with 48 to 50 percent protein in the seed. Unfortunately, they are lower yielding than the current commercial varieties which average 40- to 43-percent seed protein. This germplasm is being distributed to public and private soybean breeders to explore the potential for developing new varieties with both high protein and acceptable yield.
Cherry and Nut Tree Diseases Avoided	The most serious diseases of irrigated cherry and nut orchard crops in California are crown and root rots that kill the trees. ARS research has shown that these diseases can be avoided by an irrigation regime which does not allow the soil to become saturated for more than 4 hours every 2 weeks.
Cause of Sugarcane Disease Discovered	Ratoon stunting is one of the most damaging diseases of sugarcane throughout the world. Recently, ARS scientists discovered that an unusual form of bacterium was responsible. Coupled with this discovery, ARS developed the technology to detect this highly infectious pathogen in sugarcane "seed" stocks. Ratoon-stunting, disease-free cultivars are now available to growers.

Sex Lure to Control Yellow Jackets	An artificially prepared pheromone (sex lure) which attracts a predaceous insect, the stink bug, has also been found to attract yellow jackets. While yellow jackets are highly beneficial predators, they are also a severe nuisance in areas of human activity. The development of this pheromone will facilitate the selective control of yellow jackets.
Natural Plant Chemicals Control Weeds	Recent ARS laboratory tests have shown that populations of such serious weed pests as velvetleaf, pigweed, and lambsquarters decline sharply when planted alongside germinating sorghum. Current research is looking at ways to synthesize weed-inhibiting chemicals produced by sorghum roots to develop herbicides that can be used without risk to the environment.
Twinning in Beef Cattle Successful	Selection for twinning can be used to increase calf crop in beef cattle. In a selected group of cows, a live calf crop of 105 percent was realized from 129 females that were 3 years old or older. Twinning rate was 10 percent for cows selected from dams producing three or more sets of twins. This finding means that twinning rate can be increased by selection. Since two-thirds of the feed cost for beef production is maintenance cost of the reproducing animals, the increase in calf crop through selection for twinning cows could significantly reduce production cost.
Experimental Bluetongue Vaccine	An experimental bluetongue virus vaccine has been developed. Bluetongue virus was killed with controlled irradiation, and the killed virus was found to be protective against the disease when given to sheep in two sequential doses. The application of this product could lead to successful programs for controlling and eradicating this virus infection of sheep, cattle, and zoological ruminants.
Possible Vaccine for Poultry Coccidiosis	A genetically engineered antigen could become a key to developing a vaccine against coccidiosis, an intestinal disease of poultry that cost the industry $300 million a year. ARS scientists, using genetic engineering techniques, are the first scientists to artificially produce an antigen that protects against a species of coccidia. ARS scientists are now working with Genex Corporation to turn the antigen into a vaccine for the poultry industry.
New Method to Prevent Milk Fever	Milk fever, a disease of dairy cows that occurs shortly after calving, is characterized by low blood calcium and paralysis and results in annual losses of at least $150 million to dairy farmers. It was discovered by ARS scientists that intravenous infusion of a small amount of synthetic hormone (bovine parathyroid hormone), given to the cow a few days before and after calving, effectively prevented the disease.

Chicks Vaccinated Before Hatching

Vaccinating eggs before hatching can prevent infectious bronchitis. Infectious bronchitis virus causes a highly contagious respiratory disease in chickens and must be controlled by vaccination if severe losses are to be avoided. Today, vaccination is administered after the chicks hatch. When administered to eggs, the vaccine protected the hatched chicks against the disease. This embyro vaccination technique, applied to many different viruses, could substantially decrease the cost of vaccination to the poultry industry.

Preventing Diarrhea in Pigs

Oral vaccination was used to protect nursing piglets against diarrheal disease caused by Escherichia coli, a common cause of bacterial diarrhea and death of young pigs. Scientists found that oral vaccination of the dam given before the first and second lactations stimulated milk antibody and protected pigs during the first and second lactations. Vaccination procedures used today protect the pig for only the first few days after birth.

New Method Producing Chemicals From Tallow

The high-temperature fat-splitting of tallow to produce important fatty chemicals is an energy-intensive process which also destroys some natural qualities of the original fat. A class of enzymes, called lipases, allow fat-splitting to be carried out at low temperatures so that energy costs are reduced and the natural quality is retained. A membrane reactor containing lipase to continuously split tallow was developed. This first use of an immobilized bioreactor for splitting fats is a milestone toward adoption of this technology by the billion-dollar-a-year fatty-acid industry.

Substitute for EDB

Methyl bromide has been successfully substituted for EDB (ethylene dibromide) in quarantine treatment of grapefruit. Methyl bromide was used last season to treat Florida grapefruit shipped to California and is expected to be authorized for treating grapefruit exports to Japan in quarantine treatment of the Caribbean fruit fly. Development of this treatment will benefit U.S. citrus producers by allowing uninterrupted shipment and export of fruit.

Citrus Canker on Fruit Controlled

When the citrus canker outbreak occurred in Florida in 1984, researchers did not know if the shipments of fruit had to be restricted to avoid spread of the disease. ARS research, however, then showed that the bacteria antecedent did not survive more than 24 hours on fruit kept at room temperature without any treatment, and that the bacteria were killed immediately when fruit were dipped in 250 ppm chlorine for 2 minutes. These results showed that chlorine-treated fruit can be shipped from a contaminated area without any danger of spreading the bacteria.

CO_2 for Control of Insects in Grain

ARS laboratory studies have shown that the exposure time needed to effectively control stored-product insects with carbon dioxide can be dramatically reduced if temperatures of 90 to 100 °F are used. These temperatures can be easily obtained in the treatment of truck- or ship-type containers, of food processing machinery, and of harvested feed grains in the fall. This technique, when properly applied, is cost-competitive with conventional fumigants and has the approval of the Environmental Protection Agency.

Possible New Food Product

A 6-month study determined the effect of dietary fiber in the form of guar gum-containing food bars on humans who exhibited adult-onset diabetes. Consumption of the guar bars improved oral glucose tolerance, lowered glycosylated hemoglobin, and allowed increased glucose consumption during the euglycemic clamp (suggesting an increased sensitivity to insulin). Mineral retention was not adversely affected by consumption of the guar bars for the 6-month period. These tasty guar bars were especially developed for this study and are not available commercially. These results suggest a potential product for food processors.

New Methods for Measuring Body Fat

Total body fat can now be estimated by a quick and easy portable method that uses short wavelengths of infrared light to measure fat at key spots on the body. The method, called IRI for infrared interactions, is faster and more accurate than skin-fold measurements--the most common method used today. A second method involving bioelectrical impedance as an estimator of body composition has been found to give reliable measurements which correlated highly with the same parameters determined from underwater weighing. These methods could lead to portable machines for doctors' offices, hospitals, sport teams, and even the public to keep tabs on body fatness and physical fitness.

Expert System Helps Control region Erosion

A new computer program that embodies expert knowledge will help provide increased protection for soil in the grain-farming of the Pacific Northwest. Using air temperature records of previous years, the program will enable farmers to estimate the date by which fall seeding must be done to provide enough crop cover to keep down soil losses from erosion during the following winter.

Peanut Growth Model to Reduce Costs

A cooperative venture between ARS and Virginia Polytechnic Institute researchers is developing an overall peanut growth simulation model to help farmers with decisions such as when to apply pesticides and irrigate. Full implementation of this model throughout the Nation's peanut-growing area should help farmers reduce costs without increasing risk from diseases, pests, and drought.

Infrared Photography Helps Cotton Farmers Save $25-$30 Million

Cotton bolls in residues following harvest provide overwintering habitat for larvae of the boll weevil, cotton's most serious pest. Infrared photography has been used to detect the presence of larvae in residue bolls and thus target fields for postharvest boll-shredding operations. In a test in the Rio Grande Valley, farmers credited a detection/control program with saving $25 to $30 million in one year and reported record yields with fewer insecticide applications.

Corn Belt Expert System

ARS scientists working with five State experiment stations are developing a computerized expert system to help midwestern farmers use their personal computers in making decisions that will result in more profit and more sustainable production systems. The system is being developed to help farm operators manage such inputs as nutrients, water, herbicides, pesticides, tillage, and crop varieties.

Increased Profitability for Beef Producers

Integrated forage-livestock management systems can significantly increase profitability for beef producers. Use in a forage-cow/calf production system resulted in a 30 percent increase in land-use efficiency, 100-percent improvement in beef production, and a 75-percent decrease in cost of production per pound of additional gain. Similar results were obtained from an integrated forage-stocker production system. Beef production was increased from 44 to 185 pounds per acre while land requirements were reduced from 8 to 2 acres per stocker unit.

Royalty-Bearing Patent Licenses Increase 61 Percent

In FY 1985, 17 new exclusive or coexclusive licenses were awarded, bringing the total of royalty-bearing licenses awarded since exclusive licensing began in FY 1981 to 45, an increase of 61 percent in one year. Industry has pledged to commit a total of $30 million toward further development of these agricultural technologies. Overall in FY 1985, 33 licenses were awarded on USDA inventions: 16 nonexclusive (8 ARS and 8 FS); and the 17 exclusive or coexclusive (16 ARS and 1 FS). Also, more than 25 additional patent licenses are in the negotiation stage. During FY 1985, the Patent Coordinators Office received 666 public inquiries relating to licensing of USDA technology. This represents a sizable increase over FY 1984's 407 inquiries.

The mission of the Cooperative State Research Service (CSRS) is to advance science and technology in support of agriculture, forestry, people and communities, in partnership with colleges, universities and other research organizations, and in consonance with the Secretary of Agriculture and the intent of Congress. Its scientists work with regional and national groups to assure the quality of science and to set research priorities. It administers USDA research funds appropriated by Congress for the States, gives focus to the broad programs of agricultural research in the States, and participates in a nationwide system of research planning and coordination.

State Cooperators

The programs of CSRS are carried out cooperatively with:

- 58 State and territorial agricultural experiment stations;
- 17 colleges of 1890, including Tuskegee University
- 28 schools of forestry; and
- 29 colleges of veterinary medicine.

Most of these institutions are associated with the land-grant universities. When all publicly supported agricultural research is taken into account, including all research agencies within the U.S. Department of Agriculture, two-thirds of the full-time equivalent scientist years are found in the State agricultural experiment station system. Because of shared responsibilities between research and teaching in the universities, the actual number of scientists is far larger. This provides a wide range of talent capable of addressing most kinds of problems faced by agriculture.

Research Quality Assurance

Assurance of research quality is a top priority for both CSRS and the cooperating institutions. One method used to promote scientific excellence is the onsite special reviews, using peer panels to evaluate research productivity, program direction, and future research opportunities. In 1985 CSRS conducted 108 special reviews at 55 institutions. In addition, CSRS scientists met with 242 regional technical committees and 220 regional coordinating committees to coordinate interstate and interregional research on problems of regional and national concern.

Research Agenda Developed

CSRS in cooperation with the Experiment Station Committee on Organization and Policy sponsored a symposium and a workshop as a two-phase process designed to establish research priorities for the State agricultural experiment stations to meet the needs of the Nation now and in the future. The priorities are focused on five major areas: Natural Resources, Animal Sciences, Plant Sciences, Economic and Social Concerns, and Cross-Cutting Issues.

Embryo Freezing Simplified

Research at the University of Georgia has resulted in a simplified, onfarm procedure for freezing embryos. Cattle embryos added to the freezing medium were shown to survive freezing as well as those undergoing the more complex laboratory process. An inexpensive portable freezer can be used. This will be an important means of decreasing the loss of valuable embryos at the farm level.

Mycotoxin Analysis Improved

University of Missouri scientists have developed a rapid, inexpensive analytical test for detecting eight fungal toxins harmful to animals and people. These are the most common mycotoxins found in grains and mixed feeds. The test permits the monitoring of a large number of samples at a minimal cost and provides immediate information when a potential hazard exists. The test also furnishes regulatory agencies with data needed to allow grain to be moved interstate.

New Diagnostic Test and Vaccine

Using biotechnology research techniques, scientists at Washington State University have developed a new diagnostic test and vaccine for the highly contagious disease of cattle, vesicular stomatitis. The symptoms and rapid spread of this disease are often identical to foot-and-mouth disease and until now it has required time consuming tests to differentiate the two diseases. The new test permits identification of vesicular stomatitis outbreaks under field conditions in less than 6 hours and the new vaccine provides an immunity of much longer duration than previous vaccines.

Vector For DNA Transfer Developed

University of Illinois Agricultural Experiment Station scientists have developed a procedure by which segments of genetic code of wild corn relatives are incorporated into the DNA of pollen of common corn hybrids. Use of this technique allows introduction of unique characteristics, such as leaf rust resistance into domestic corn hybrids in 1 or 2 generations, in contrast to the 8 to 15 generations required by conventional plant-breeding procedures.

Potato Propagation Revised

Colorado State University scientists have shown that the pathogen causing blackleg of potatoes is spread through infected seed stock rather than via the generally accepted route of contaminated soil. Subsequent development of procedures to produce disease-free seed potato stock in large quantities and release to commercial growers have resulted in higher quality potatoes for the manufactured market and as fresh table stock.

Water Supplies Conserved

Texas Agricultural Experiment Station scientists have shown that inexpensive, natural animal fat emulsions can be utilized under practical field conditions as soil or foliar sprays to reduce moisture loss, thus enhancing germination and growth of small-seeded or shallow-rooted vegetable crops. This is a major

problem in the semiarid regions of the United States. In addition to its cost effectiveness, the emulsion spray procedure prevents the soil from crusting over which otherwise occurs from repeated irrigations.

Biotechnology Grants Program Initiated

Competitive Research Grants Office initiated a new $20 million grants program to support basic research related to biotechnology. Approximately 900 proposals were received. Their qualities were considered exceptionally high by the technical review panels consisting of expert scientists. A total of 166 grants were awarded based on scientific merit and relevance to agriculture. The information resulting from the research projects will contribute the basic knowledge necessary to realize the full potential of biotechnology in addressing agricultural problems.

The Statistical Reporting Service (SRS) conducts research to improve the statistical methods and techniques used to produce agricultural statistics. This research is done in support of the SRS long-range program for improving the accuracy of crop and livestock estimates at minimum cost and is directed toward better sampling, yield forecasting, and survey techniques.

Objective Yield Research and Analysis

Emphasis has been in the areas of quality assessment and improvements in the statistical methodology. Data-quality and sampling-procedure studies included (1) cooperative studies with North Dakota State University in an effort to identify potential problems with sunflower objective yield methods, (2) several studies to determine potential plot location biases, (3) a study of lab-processing errors, (4) alternative maturity code determinations in corn, and (5) evaluation of enumerator fatigue and plant handling effects. Recent operational improvements suggested by completed research include: improved verification data on lab forms, a test use of a buffer zone in the wheat survey, and more careful editing of row-space measurements.

Statistical-methodology studies produced recommendations for improved variance estimators for the yield forecasts and estimates; an alternative, simplified soybean estimator; improved sunflower forecast models; the maturity category models used in soybeans; and modeling and hypothesis testing problems with data from the complex objective yield survey design. Recent changes to the operational program based on methodology studies include using 5-year data rather than 3 to model corn yields and using fixed rather than stepwise modeling methods for soybeans.

Plant Growth Simulation Modeling

Research continues on plant growth process simulation models as candidates for supplementing the present yield forecasting system. Growth simulation models are structured with functional relationships representing growth of the plant. Initial evaluation and validation efforts for corn and wheat are not promising. Model development for these crops has been deemphasized until more basic plant research is completed by university investigators. Through cooperative agreements with university scientists, model development research is underway for soybeans, cotton, and grain sorghum models. Efforts for soybeans and cotton are more promising. Data were collected at five locations dispersed throughout the soybean production region for model validation. Continued efforts to validate the cotton model with existing data sets are underway. For these two crops, effective techniques have been developed to utilize survey measurements to true-up model response. Research papers covering the process model analysis and revised forecasting techniques are under preparation.

Computer Assisted Telephone Interviewing (CATI) Research	The California State Statistical Office (SSO) used CATI successfully to collect data for several major surveys in FY 1985. The surveys were Cattle Multiple Frame, June Acreage, Rice Stocks, Processing Tomatoes, Fall Acreage and Production, and Cattle on Feed. The Nebraska SSO completed a year of quarterly Hog Multiple Frame surveys using CATI operationally. New applications of CATI used in both States included updating files for the List Sampling Frame. Developmental work included a new training module for CATI instruction. CATI was used for the first time in Nebraska for the Milk Production Survey. Other activities included testing of an instrument to automatically schedule telephone calls, preparing user documentation and training manuals, and developing instruments for the Farm Labor Survey and Integrated Survey Program. The CATI software was also in the process of being loaded into some new hardware for use in eight additional SSO's.
Area Frame Sampling Research	Two projects are underway to evaluate the size of the land area or segment used during data collection. One study will develop procedures for determining the most efficient size for a segment in terms of cost and precision of the agricultural estimates. The other study, which is a simulation study, will recommend the most desirable tolerances to place on segment size when manually drawing off segments from randomly selected frame units during the sample-selection process.
Area Frame Construction Research	Research to compare operational stratification procedures for area sampling frame construction, which are based on photo interpretation, with a method using computer classification of digital Landsat data was carried out in three counties in Florida and four counties in Wyoming. The data are currently being analyzed. Also, another study is underway in selected counties in New York to evaluate an automated approach to frame construction using Landsat images on a workstation. The purpose of these studies is to investigate the use of Landsat data and automated techniques for area frame construction.
Small-Area Estimation Research	Research continued on the development of a model-based procedure which uses historical and current data to make district and county estimates. Analysis was expanded from a list estimate to include an adjustment for nonoverlap (measure of list incompleteness) for the North Carolina acreage estimates. Data for 3 years have now been evaluated. Procedures are being developed to account for data incompleteness. Research is underway in a second State with different commodities of interest.
Integrated Survey Project (ISP) Research	Several areas of research were underway to evaluate data collection in the ISP States. Analysis was completed on comparison of the tract, farm, and weighted direct expansion

estimators. Nonsampling errors associated with each estimator were evaluated and survey cost data were summarized with comparisons by State. Research also included development of a revised stratification design with multivariate procedures recommended to determine strata and sample allocations. Analysis of poststratified hog data were completed in one State. The evaluation of sample rotation and potential biases is continuing. Imputation procedures and methods for handling previously reported data are also under study. In addition, investigation of procedures to handle outliers or atypical reporting units is underway.

Research to Develop Methodology for Using Satellite Data

In 1985, Landsat multispectral scanner data were used with SRS ground-gathered data to calculate improved crop area estimates at the State and county level in Arkansas, California, Colorado, Illinois, Indiana, Iowa, Kansas, Missouri, and Oklahoma. Data were obtained from both Landsat 4 and 5 which resulted in much better coverage in the major producing agricultural areas. Data from two or three satellite overpasses were combined to provide increased precision in several States. This was in contrast to the use of a single satellite overpass in previous years.

Estimates for planted and harvested acreage of winter wheat were obtained in Colorado, Kansas, Missouri, and Oklahoma. Planted acreage estimates will be obtained for wheat, cotton, corn, and rice in California; rice, corn, and soybeans in Missouri; rice, cotton, and soybeans in Arkansas; and corn and soybeans in Illinois, Indiana, and Iowa. In addition to the crop acreage estimates, a cooperative project between the Statistical Reporting Service, Soil Conservation Service, and Forest Service to obtain estimates of major land covers including forests and nonagricultural uses in Arkansas was completed.

In 1985, research continued on the use of satellite data to improve area estimates for various specialty crops. Much of this work was done in cooperation with other organizations. Projects were carried out in Idaho for potatoes, New York for orchards, vineyard, and vegetable crops, and California for numerous specialty crops. A special area sampling frame for orchards and vineyards is being constructed in New York as a result of this research.

Significant improvements in the methodology have been made during the past decade. This is reflected in both the improved estimates and a reduction in the cost per State which has dropped from $300,000 in 1978 to $140,000 in 1985. Much of the California analysis was conducted using a microcomputer at the local site in 1985. This technology offers much promise for reducing processing costs in the future.

Research on statistical methodology, use of data from the Thematic Mapper sensor, data processing, including both hardware and software, automation, and other techniques to increase efficiencies continued in 1985. Major developments included improved batch data processing capabilities, conversion of many analysis steps from clerical hand coding to computer routines and improved county estimate software.

The Economic Research Service (ERS), an agency of the U.S. Department of Agriculture, produces economic and other social science information as a service to the general public and to aid Congress and the Administration in developing, administering, and evaluating agricultural and rural policies and programs. ERS monitors, analyzes, and forecasts U.S. and world agricultural production and demand for production resources, agricultural commodities, and derived food and fiber products. ERS also measures the costs of and returns to agricultural production and marketing; evaluates the economic performance of the U.S. agricultural production and marketing systems; and estimates the effects of current and alternative government policies and programs on farmers, rural residents, rural communities, natural resources, and U.S. society in general. In addition, ERS produces economic and other social science information about the organization and institutions of the U.S. and world agricultural production and marketing systems, use and conservation of natural resources, and economic conditions of rural residents.

ERS-produced information is made widely available to the general public. It is released through ERS research monographs, outlook and situation reports, and staff reports and through professional and trade journals (including ERS' own journal, Agricultural Economics Research), magazines (including ERS' own magazines, Agricultural Outlook, Farmline, Rural Development Perspectives, and National Food Review), radio, television, newspapers, direct computer access, and frequent participation of ERS staff at various public forums.

ERS Provided Background on Farm Bills

ERS policy analysts worked on the Administration's farm bill, which stressed market orientation that would eventually reduce the Government's role in price and income supports, stockholding, and production control programs. ERS staff also reviewed over two dozen farm bills proposed by Congress and farm groups.

Farm Financial Conditions Studied

ERS determined that of the farms with the most serious financial problems at the start of 1985, over 38,000 were technically insolvent, 55,000 had debt/asset ratios between 70 and 100 percent, and 121,000 farms had ratios of 40 to 70 percent. Over 45 percent of farm operators' debt was owed by those with both high debt/asset ratios and insufficient net cash income. Of the farm loans not fully serviceable in 1985, over 32 percent were owed to the Farm Credit System, almost 18 percent to the Farmers Home Administration, and about 26 percent to commercial banks. The number of agricultural bank failures increased from 7 in 1983, to 25 in 1984, and 44 in the first 9 months of 1985.

Financially Troubled Farms Estimated	The ERS Farm Costs and Returns Survey conducted in the spring of 1985 indicated that 320,000 farms closed out 1984 with a debt load exceeding 40 percent of their assets. Approximately 214,000 of these units were probably unable to cover production expenses, family living needs, and loan repayments out of current farm and nonfarm income.
Land Value Declined Reported	Farmland values declined 12 percent from April 1984 to April 1985, the largest decrease since the early 1930's. Hardest hit were farms in the Corn Belt, Lake States, and Northern Plains where values fell 20 percent, according to an ERS survey.
Financial Deregulation Reviewed	Preliminary ERS research suggests that rural banks should not be particularly adversely affected by financial deregulation. Rural and urban banks have adapted equally well to changing trends. However, the heavy concentration of farm loans held by rural banks makes them susceptible to continuing deterioration of the agricultural economy.
Slow Recovery Tracked in Farm Sector	Economic recovery in the farm-dependent areas--700 of the Nation's 2,500 rural counties rely on farm income--has been stymied by the depressed agricultural situation and the slow growth of the U.S. economy since the 1979-82 recession, according to an ERS study.
World Price and Export Return Relationship Determined	ERS researchers indicated that in the first year after a change in world prices, the volume of exports may shift less in percentage terms than the opposite movement in prices, resulting in a loss of earnings if U.S. export prices declined. The change would not greatly affect export revenue in the second year; but after that, U.S. crop export revenues could move considerably in the opposite direction of a world price change.
Agriculture and Trade Reviewed	ERS economists evaluated trade policies of the United States and other major countries. Commodity price and income policies, including embargoes, subsidies, credit, and food aid were studied. Based on government expenditures for interventions, Japan ($15.8 billion) and the United States ($8.5 billion) topped the list.
Policy Data Base Started	ERS developed a large data base documenting trade and farm policies to assess the trade barriers and export subsidies of U.S. competitors.
World Economic Conditions Studied	Pilot studies were done to calculate specific macroeconomic policy changes on U.S. agricultural trade. One study shows that a rescheduling of Mexican debt would increase U.S. exports to that country. Another notes that increased protectionism in world markets would damage the future prospects for U.S. agricultural exports, while steady and robust world economic

	growth and a weaker dollar could lead to increased U.S. farm product sales.
African Food Crisis Estimated	The African food crisis is so extensive that a solution requires economic development of both the agricultural sector and total economy, according to ERS researchers. Usually, those countries do not have sufficient foreign exchange to commercially purchase food to fulfill their needs.
Farm and National Economies Linked	ERS researchers determined that the linkages between the U.S. farm and national economies are so close that conditions beyond the farm gate can affect agriculture as much as farm programs. Also, global business cycles have a major effect on the demand for U.S. farm products. Each dollar earned by farm exports stimulates another $1.37 of output in the U.S. economy.
Changes in the Livestock and Dairy Sectors Analyzed	ERS analysts found that the average number of calves born annually per 100 beef cows and breeding-age heifers increased from 79 in 1975 to 87 by 1980. Average weight per head of cattle sold or placed on feed by cow-calf operators increased between 11 and 32 pounds; and total weight was up 7.6 percent. However, returns to operator management and risk have been increasingly negative since 1979. Milk production has increased more in many western, southwestern, and eastern States than in traditional dairy States. Investment in large-scale dairies in the Southwest is more profitable than in smaller dairies in the northern areas.
Slaughter Plant Number Declined	An ERS study revealed that the number of meatpacking plants decreased while the size and proportion of business by large firms increased in the past decade. In 1972, there were 6,156 commercial plants, rising to 6,255 by 1976, but dropping to 5,558 by 1983. The number of plants slaughtering more than 500,000 head annually increased from 3 to 12 between 1972 and 1982 and accounted for 36 percent of slaughter.
Water Pollution Economics Studied	An ERS interim evaluation of the Rural Clean Water Program found that the severity of pollution is not a good indicator of the economic damages being caused by agricultural activities. Economic damages and potential benefits of reduced pollution depend heavily on the water uses, such as recreation, that are being impaired, and the number of people affected.

AGRICULTURAL COOPERATIVE SERVICE (ACS)

Agricultural Cooperative Service (ACS) provides education, research, and technical assistance to help farmers develop cooperatives so they can stand on their own in the marketplace. The Agency is the information base within Government whenever issues of policy, legislation, or regulation concerning farmer cooperatives arise.

1984 Ag Co-op Business Volume Was Record High

Combined business volume of 5,782 agricultural marketing, purchasing, and service cooperatives for 1984 was $73 billion, up 9.4 percent from 1983 and up 2 percent from the former record high of $71.5 billion in 1981. Net margins, however, were $1.01 billion, off 4.4 percent from 1983. Total assets were $29.2 billion, up about 1.3 percent, while member patron equity was $12.2 billion, an increase of 5.6 percent. Cooperative memberships dropped to 4.84 million from 4.95 million.

Top Co-ops' Sales And Margins Up; Debt, Assets Dropped

Sales of the 100 largest cooperatives were $53.2 billion in 1984, an 8.9 percent increase from 1983. Net margins of nearly $421 million were up 6 percent. Members' equity of $5.6 billion represented an increase of nearly 5 percent. Assets of $16.6 billion represented a 2 percent decline. Most significant change was an 8 percent drop in debt to $6.4 billion.

Director Liability, Merger Research Highlighted

Research into planning, negotiating, and implementing mergers for cooperatives was accomplished in 1984. Cooperatives reorganize most frequently by merger, acquisition, or consolidation. The number of cooperative reorganizations occurring each year and the amounts of sales and assets they represent are considerable and ACS continues to work in this area.

Research was also conducted into the field of director liability. Farmers and others who serve as directors of farmer cooperatives are subject to responsibility rules applicable to all corporations and are subject to the same liabilities when those responsibilities are not met. This research comes at a propitious time as many farmers and their cooperatives are facing financial difficulties.

Bargaining Co-ops Handled Majority Of Potato Crop

Potatoes are the most important vegetable crop in terms of tonnage and value grown in the United States. Bargaining associations representing more than 3,000 growers bargain for nearly 60 percent of the processed potato crop in the Nation. Per capita consumption of fresh potatoes has declined while per capita consumption of processed potatoes has increased from 39.3 pounds in 1965 to 65.5 pounds in 1981. Of the 50 States, 38 grow enough potatoes to be considered commercial producers.

Fishery Co-ops Long Used in the United States

Some fishers have used cooperatives for many years, but little was known about the extent of cooperative involvement in the U.S. fishing industry. An ACS study provides a profile of fishery cooperatives as an aid in making them aware of themselves and some of their key characteristics as a sector of the fishing industry.

Information on structure and financial performance will help fishers plan new cooperatives and be useful to managers and boards in planning change for their own cooperatives. Data are provided in detail for finfish, lobster, and shrimp cooperatives as groups.

Forestry Co-ops Helped Plan Production, Aid Annual Sales

Research was accomplished into methods of estimating annual marketings by members of forestry cooperatives to formulate long-range business plans. A reliable prediction of total annual sales by the cooperative is possible, but individual product estimates are subject to significant errors. The forest is difficult to evaluate from a business perspective because of its wide variety of tree species, growth rates, and markets.

Petroleum Co-ops Researched in 1984

During 1984, ACS studied the vital role cooperatives played in supplying petroleum products to U.S. farms. The flow of petroleum products through the vertical levels of cooperatives, petroleum system, from crude oil acquisition to retail distribution, was analyzed. Cooperatives supplied an estimated 37 percent of all petroleum fuels used in U.S. farm production in 1982, continuing the long-term trend in cooperatives' share growth. Between 1979 and 1982, cooperatives increased proved oil reserves by 45 percent.

Local Co-ops Big Handlers of Grain

A total of 2,060 local cooperative associations handled 4.7 billion bushels of grain during the 1982-83 marketing year. This is about 41 percent of all grain sold off-farm during the year. Corn, at 1.5 billion bushels, ranked as the leading grain marketed; wheat was second at slightly under 1 billion bushels.

Supply Co-ops In Midsouth Grew At Faster Rate

Supply sales of cooperatives in the Midsouth grew at an annual rate of 43 percent from 1951 to 1983, a rate unequaled by supply cooperatives in any other region of the United States. Total cooperative sales of 300 member locals reached $1.1 billion in 1983. Supply sales in the 5-State area averaged 13 percent of farm production expenditures in 1973 and rose to 22 percent 10 years later. Reasons for the growth were that regionals operated generally free of competition from other cooperatives, excellent management practices and teamwork, and support and commitment by cooperative members and employees.

ACS Dairy Research Anticipated 1985 Farm Bill Proviso

Responding to board interest in a means of appropriately compensating dairy cooperatives for market-wide milk supply-balancing services, ACS published research demonstrating how to determine market-balancing costs and ways to equitably distribute pooled funds to cooperatives performing market-wide supply-balancing services. Market-wide service payments for milk supply-balancing services are now authorized in the 1985 farm bill (Title I, Subtitle A, Sec. 133).

Benchmark Financial Ratios Developed For Dairy Co-ops

Balance sheets and operating statements, as well as total raw milk receipts and percentages sold raw, were used by ACS to develop benchmark financial ratios for dairy marketing cooperatives. Data from 291 cooperatives, representing 67 percent of all dairy marketing cooperatives and 87 percent of the raw milk received (or bargained for) by cooperatives, were summarized for five types and then a combination of three types and three sizes of cooperatives.

ACS Involved in 62 Technical Assistance Projects

ACS was involved in a total of 62 technical assistance projects during the year, of which 42 were for emerging or developing cooperatives. Upward of 20 different commodities were represented in these projects. There was also an examination of cheese, butter, and powder manufacturing costs at 32 cooperative plants; assessment of the feasibility of merging two grain marketing cooperatives in Iowa and two vegetable-marketing cooperatives in Hawaii; assistance in evaluating the feasibility of implementing a peanut shelling and marketing cooperative in Virginia; and development of financial projections for an alfalfa pelleting and hay-marketing cooperative in Tennessee.

ACS Information Staff was Involved In Diverse Projects

During 1985, ACS staff were active in AIC's National Institute on Cooperative Education, Graduate Institute of Cooperative Leadership, the annual meeting of American Agricultural Economics Association and National Council of Farmer Cooperatives, various State cooperative council meetings, State cooperative attorney workshops, and guest lecturers for university courses dealing with cooperatives. In these and other meetings, and through requests, ACS staff distributed 116,819 copies of its publications.

Human Nutrition Information Service (HNIS) provides information required to improve public understanding of the nutritive value of foods, the nutritional adequacy of food supplies and diets, and the selection of nutritious and healthful diets. Agency research includes the compilation and dissemination of food composition information, the monitoring of food supplies for nutrient content and of food and nutrient consumption by U.S. households and individuals through national surveys, and the development of materials and techniques to help Americans improve their nutrition and reduce risk of disease through better diets.

Dietary Guidelines Revised

The core of Federal dietary guidance since 1980 "Nutrition and Your Health: Dietary Guidelines for Americans" was revised by USDA and DHHS based on recommendations of a Dietary Guidelines Advisory Committee of outside nutrition scientists. HNIS coordinated this effort. USDA is distributing 1 million free copies and encouraging others to print and distribute additional copies of the revised bulletin.

Continuing Survey System Initiated

This new dimension to the National Nutrition Monitoring System (NNMS) was initiated in April 1985. It is the first nationwide dietary survey to be conducted on a continuing basis. The first report, released in December, presents information on food and nutrient intakes by a core monitoring group of women and children in spring of 1985 compared with similar information collected in spring of 1977. The provision of results within 6 months after data collection illustrates major advances in the Agency's capacity to provide timely information on food consumption and dietary adequacy.

Nutrient Data Base Developed

A computerized nutrient composition file for over 4,700 food products was developed for estimating the nutrient content of diets reported in the Continuing Survey of Food Intake by Individuals. The file extends the number of dietary substances covered for survey purposes from 15 to 28. It is the first USDA nutrient composition file for surveys to include data for dietary fiber, zinc, sodium, potassium, copper, folacin, vitamin E, carotene, alcohol, cholesterol, and total saturated, monounsaturated, and polyunsaturated fatty acids.

Criteria for Diets Studied

"Nutrient Adequacy: Assessment Using Food Consumption Surveys" reported the findings of a committee formed by the Food and Nutrition Board, National Academy of Sciences, and sponsored by HNIS. The report describes a probability approach to assessing risk of nutrient deficiencies based on dietary data from surveys.

Data on Nutrient Content of Foods Published	"Nutritive Value of Foods," an HNIS bulletin for nutrition educators, health professionals, and the general public, was updated and expanded. It now shows the caloric values, percent moisture, and contents of 17 nutrients for about 900 foods. The nutrients are protein, fat, carbohydrate, calcium, phosphorus, iron, potassium, sodium, vitamin A, thiamin, riboflavin, niacin, ascorbic acid, cholesterol, and total saturated, monounsaturated, and polyunsaturated fatty acids.
Nutrients in Food Supply Estimates	Estimates of the nutrient content of the 1984 food supply were added to the historical series of annual estimates, beginning with 1909. Data are published in Agricultural Statistics, Statistical Abstract of the United States, Nutritional Food Review, and Food Consumption Price and Expenditures.
Cost of Food at Home Published	The cost of food in the four USDA family food plans--thrifty, low-cost, moderate-cost, and liberal--was estimated monthly, released to the press, and published in Agricultural Statistics, Statistical Abstract of the United States, and Family Economics Review. The cost of food in the thrifty food plan is used by the Department as the legal standard for benefits in the Food Stamp Program.

The mission of the Agricultural Marketing Service (AMS) is to stimulate competition and to increase efficiency in the marketing of agricultural products. While the Agency is heavily involved outside the research arena, it is charged under the Agricultural Marketing Act of 1946 ". . . to promote through research study, experimentation, and through cooperation among Federal and State agencies, farm organizations, and private industry, a scientific approach to the problems of marketing, transportation, and distribution of agricultural products . . ."

The Agency's research activity includes conducting market surveys and analyses to determine needs for marketing and processing facilities; designing such facilities; and conducting studies to improve the marketing, handling, processing, and distribution of agricultural products. An important part of program activity is the assistance provided to State and local governments and industry groups in market development activities.

San Diego Food Center Development

AMS has developed plans for a new 150-acre, $100 million wholesale food distribution center to serve San Diego County and major portions of southern California. The new center will have about 721,000 square feet of enclosed space when fully developed. Improved efficiency of wholesale operations and space for expansion on the new market would not only cover the costs of developing and operating the center but would also generate substantial benefits for the food industry, local communities, and the food-buying public. This major new market will represent a substantial improvement in the region's wholesale food industry and help maintain a major area industry vital to the local economy.

Marketing Facilities in New York

A statewide series of studies have been initiated on New York's wholesale food distribution facilities. Studies in Buffalo and Syracuse focus on developing new wholesale food distribution facilities and modern farmers' markets to replace existing inadequate and antiquated facilities. Wholesale food firms in an eight-county area around Buffalo have been surveyed and data analyzed to develop new facility recommendations. Growers near Buffalo and Syracuse have been surveyed to develop information needed to support plans for new market facilities for those two cities. Wholesale firms near Syracuse will be surveyed in a later stage of the project.

A study of existing operations on the Hunts Point Market in New York City is underway to develop new planning tools for future market development on this wholesale food distribution center. Over $3 million a day in fresh fruits and vegetables alone move through this market; about 3,000 buyers a day come to Hunts Point to buy supplies for New York's restaurants, stores, and commercial feeding establishments.

Energy Recovery in Food Plants	Research is underway to find ways to recover and use the lost ambient heat generated by boilers and refrigeration equipment in food processing plants. This substantial amount of energy is now discharged to the outside while other energy sources must be used to maintain internal temperatures. Research findings indicate that most food plants can save up to 25 percent of their total fuel costs by using ambient heat for heating and other purposes. The findings also show potential for application to nonfood plants.
Computer Feasibility for Produce Wholesalers	Research has been completed which (1) defines information requirements for fresh fruit and vegetable wholesalers at selected volumes, (2) determines alternative systems to satisfy these requirements, and (3) develops cost estimates for each system. The system recommended for most wholesalers with annual sales up to $15 to $20 million could pay for itself in a year or have a 5-year savings of $850,000.
UPC Coding of Produce	A list of over 800 produce items together with size designations has been developed to serve as the basis for standardization of price lookup and variable weight UPC codes. Potential benefits include better data on product movement and increased efficiency at the checkout counter of supermarkets.
Improved Meat and Poultry Inspection Station Designs	Through a joint project with FSIS, research is being conducted to reduce stress on USDA inspectors and improve productivity in meat and poultry processing. Inspection is seen by some firms to be the limiting factor in plant output. They indicated that with the same personnel, equipment, and facilities, they could handle more units, reducing per unit costs, and increasing efficiency if they were not restricted by inspection. Through ergonomic and illumination engineering, improvements have been developed that will facilitate operating the plants at higher volumes while reducing the stress on inspectors.
Egg Pricing	Research on egg-pricing efficiency and the economic implications of price-volatility risk in the egg industry is being conducted in cooperation with Auburn University. It will (1) document changes in egg-price volatility at all market levels, (2) determine egg-pricing efficiency, (3) ascertain marketing-margin behavior, and (4) quantify the social cost of price volatility.
Cantaloupe Marketing Systems	Labor, equipment, and material costs for alternative harvesting, handling, transporting, and local delivery were analyzed. Implementation of the recommended least cost methods would save $0.34 per container over the present methods.

Exporting Dry Edible Beans to Europe	Test shipments of dry navy beans in bulk are being conducted and evaluated, based on methodology used to achieve improved product arrival condition of dry cranberry beans. Domestic bulk rail shipments were monitored to establish benchmark data for export research.

The Office of Transportation (OT) helps assure that there is an efficient and equitable transportation system serving the needs of agriculture and rural areas. This is accomplished through research on specific transportation problems, analysis of agricultural impacts of policy changes and proposed changes, and informational assistance to shippers of agricultural commodities and carriers.

Impacts of Rail Deregulation

OT published two reports in 1985 that examine both benefits to agriculture and concerns that remain unsolved since deregulation in 1980. The last involves the lack of protection afforded small shippers by current rate reasonableness standards, the unrestricted cancellation by carriers of joint rates and reciprocal switching, and the inequities that can result from contact rate secrecy. Grain shippers in 43 States replied to a survey regarding specific operational practices and rail contracts. A cooperative study with Kansas State University in 1985 examined changes in both the grain marketing system and prices paid to Kansas farmers for wheat spanning the period since rail deregulation in 1980. The information gained through OT's research was provided to the Congress during oversight hearings on the Staggers Rail Act.

Timber for Rural Bridges

OT has developed information and data on needs, conditions, and extent of the rural transportation system. This information is used to analyze policies, to assess the economic performance of the marketing system for agricultural products, and to improve the quality of decisions made at the Federal, State, and local levels concerning the rural transportation system. Special attention was directed to the economical replacement and rehabilitation of rural bridges. OT helped the U.S. Forest Service develop a technology transfer plan for assisting State and local officials in constructing new and replacement timber bridges on the rural road system. In addition, OT conducted site visits to evaluate the feasibility of using timber as a safe and economical alternative for replacing deficient rural bridges. The timber bridge technology developed by the U.S. Forest Service and the American Institute of Timber Construction serves as a base to encourage the use of timber as an alternative to concrete and steel bridges on the rural road system. OT is helping to implement the technology transfer plan which includes the development of a timber bridge design and construction manual, the dissemination of information to rural officials, and the conduct of on-site demonstrations.

Alternatives to Rail Line Abandonments

OT has become involved in helping farming communities and agriculture-related industries deal with railroad abandonments. OT helped establish the Fairmount & Western Railroad in Robeson County, North Carolina, which is the State's largest corn producing county. OT helped establish the Franklin County

Railroad Corporation and the Nash County Railroad Corporation, two short line railroads in North Carolina. Current efforts are directed toward helping officials representing North Carolina's legislative, transportation, agriculture, and commerce offices and agriculture organizations study the feasibility of a modern rail-barge operation to replace the present rail bridge over the Albermarle Sound as an alternative to abandonment of the line.

New Package for Shipping Bees

OT developed and tested a new fiberboard tube packaging system for the shipment of bees. The tube system replaces the wood-and-wirescreen cages that have been used since the 1800's. The screen cages are easily broken and release bees in aircraft baggage bay and mail trucks. The new tube package, for which USDA will hold a public patent, is much stronger and no more costly than the traditional cages. Further testing on export shipments overseas will be completed in 1986.

Refrigeration Systems Evaluated in Trailers

Research with industry cooperators to evaluate both mechanically and cryogenically refrigerated multi-compartmental trailers used for combination fresh and frozen food deliveries found that cryogenically refrigerated trailers operated at the least cost and provided the fastest temperature recovery after door openings. A final report is forthcoming on this project, which was completed in 1985.

Potato Bruising in Transit

Losses due to bruising of potatoes are estimated to be $125 million annually. OT research has determined that very little bruising occurs in transit, although considerable bruising results from handling during vehicle loading and unloading. A recent study estimated the degree of handling abuse that will result in bruising damage.

Shipping Oak Lumber

Research was completed on the transportation and handling of oak lumber from several Eastern States to the European Community. OT found that weight restrictions on U.S. highways and at U.S. ports limit exports for oak logs and lumber. Transportation efficiency could be improved by combining individual shipments of oak from Baltimore, the major port of export for oak to the Federal Republic of Germany, the major recipient. Shippers and carriers could also reduce costs by taking advantage of provisions in the Shipping Act of 1984 and the Export Trading Company Act.

Transportation of Livestock Exports Studied

OT cosponsored and participated in a scientific and technical exchange with Australia and New Zealand studying all aspects of livestock export. Australia and New Zealand have the largest livestock export programs in the world. Information on their latest transportation technology and preconditioning treatment of animals for the export trade are being disseminated to American livestock exporters.

Caribbean Basin Initiatives

A principal problem in exporting agricultural products from Caribbean nations is the adequacy of services and facilities for the handling of perishable products. Since transportation costs and services are predominant impediments, OT participated in workshops and conferences sponsored by the Agri-Business Promotion Council, Agency for International Development, and USDA to discuss the packaging, handling, and transportation of perishables. OT also cooperated with the Office of International Cooperation and Development in conducting workshops in several CBI countries on similar topics.

Export Handbook Revised

OT revised its "Export Handbook for U.S. Agricultural Products." This handbook provides shippers of agricultural products with a brief but well-defined set of guidelines to help in foreign market competition. Topics include general shipping information, product selection, packaging, storage, handling, loading, and transport, as well as product disorders.

Conferences and Workshops Held

On different occasions OT cosponsored two agricultural transportation conferences that examined the effects of recently enacted transportation legislation: one with the National Association of State Departments of Agriculture and one with Western Growers Association. OT also cosponsored with the U.S. Department of Commerce two conferences on export trading companies designed to provide information to potential ETC participants and targeted at agricultural exporters. A Mid-America Rural Road and Bridge Conference was held in cooperation with the Illinois Department of Agriculture and the Illinois Cooperative Extension Service to share with State and local officials information about and strategies for solving rural road and bridge problems.

The mission of the Office of International Cooperation and Development (OICD) is to coordinate and conduct the Department's international programs in agriculture and related fields.

International Research and Education Programs include scientific and technical exchanges, administration of collaborative research, representation of USDA and U.S. Government research and educational interests in international organizations, and training and facilitating private sector involvement in agricultural development and cooperation. Programs are conducted cooperatively with other USDA and U.S. Government agencies, universities, and the private sector.

Heliothis

A special workshop on the insect Heliothis was one of several activities commemorating 25 years of agricultural cooperation between India and the United States. Heliothis feeds on such cultivated crops as cotton, corn, and sorghum, as well as peas, beans, and peanuts. In caterpillar form, Heliothis causes massive destruction because it is highly mobile, voracious, and directly attacks the fruit section of its host plant. Increased exchange of natural enemies of Heliothis between U.S. and Indian scientists has enhanced research efforts to identify natural controls for this pest.

Listeriosis: Yugoslavia

U.S. scientists and Yugoslav researchers have devised a skin test--much like the one used to test for tuberculosis in humans--that detects the presence of listeria bacteria in cattle. By the end of 1986, researchers hope to learn how listeriosis is transmitted by carriers, an important step needed to combat the disease. The new skin test for listeria lets veterinarians test suspected cattle for the presence of the bacteria. If these cows can be identified and isolated, other animals and people will not suffer the risk of contagion. Using the skin test, veterinarians can pinpoint diseased animals and clear herds of infection. The cycle from bacteria to livestock to humans is then broken, halting the spread of infection to other animals and people.

African Witchweed: Sudan, Senegal, Botswana

African witchweed, an introduced weed pest of corn, has become a serious problem for corn growers in North and South Carolina. According to informed sources, African witchweed causes more crop damage than any other plant pest. Through a cooperative research agreement, Old Dominion University, Virginia, is studying the parasitic weed pest in collaboration with scientists in the Sudan, Senegal, and Botswana. Because importing witchweed for research purposes is prohibited, this project provides U.S. scientists an opportunity to study this crop menace in its native habitat.

Remote Sensing: France

Cooperation continued with France on remote sensing during FY 1985. French scientists and USDA's Statistical Reporting Service developed an agreement so that data from a new French earth-observation satellite (SPOT) will be easily accessible to U.S. users. Collaboration with the Agricultural Research Service focused on possible future uses of SPOT for new spectral types of remote sensing, such as microwave and thermal studies. The French satellite has resolution three times greater than the current U.S. satellite used for thematic mapping, and can be "pinpointed" to record several angles of the same site. Since these features make it potentially useful in managing forests, a Forest Service scientist visited France to explore the satellite's capabilities in determining height and density of tree stands in the Western States. By cooperating with their French counterparts, USDA officials have been able to advance many aspects of the U.S. remote sensing program, while avoiding the tremendous costs associated with new satellite development.

Exchanges Resumed: China

In a May 1985 meeting with Ambassador Han Xu, Secretary Block announced the decision to resume agricultural exchanges under the US-PRC Agreement on Cooperation in Science and Technology. The exchange program, initiated in 1978, has sponsored many cooperative programs including the study of biological control of pests, forest genetics and tree improvement, soybean and citrus germplasm exchange, and land and water management. More than 450 U.S. and Chinese scientists have participated in the program. Following a review of the exchange program's objectives, limited activity has resumed including the September 1985 visit to China by an ARS entomologist. This scientist initiated work on a symposium on biological control of insect pests to be held in China in fall 1986.

Mexico: Africanized Bees

In FY 1985, OICD funded two scientific and technical exchanges with Mexico to help control the advance of the Africanized bee. These cooperative activities were in direct response to concerns raised by U.S. bee scientists and industry representatives over the impact of Africanized bees on pollination efficiency and the need to establish a baseline to monitor the arrival, dissemination, and impact of Africanized bees. Information obtained will be used to address potential problems for beekeepers and the public including (1) excessive swarming of Africanized bees, which reduces honey production; (2) the aggressive behavior of the bees, which endangers human and domestic animals; and (3) absconding or abandoning of hives.

Biological Control of Plant Pests: The Netherlands

A research project in collaboration with scientists in The Netherlands is studying the behavior of Cotesia marginiventris, a parasitic wasp that attacks and deposits eggs in the larval stages of several moth pests, including the corn earworm, the cabbage looper, and the fall armyworm. Preliminary results show

that the wasp locates her hosts by following odor trails emitted by host larvae feeding on plant material. Ultimately, knowledge from this study may lead to the use of this parasitic wasp for effective pest control.

Potato Germplasm: Federal Republic of Germany

The major objective of this OICD program is to provide for the efficient movement of genetic traits between various Solanum species and cultivars by developing and exploiting cell fusion, tissue culture (microspore and anther cultures), and other genetic techniques. These means will permit bypassing the current natural barriers to hybridization between species and cultivars. Useful variants or mutants are being screened and selected for analysis and breeding. Conventional- and novel-breeding procedures are being used by ARS and University of Wisconsin scientists in collaboration with scientists in West Germany. The results of this work have generated materials with which to examine the possibilities of somatic fusions for transfer of genetic traits from wild species into cultivated plants. With these procedures, genes that hitherto were not available to plant breeders because of sexual incompatibilities may now be used to protect our crops.

Biocontrol of Buffalo and Bush Flies: Australia

The loss in U.S. meat and milk production due to horn and face flies is estimated at over $600 million, and successful biological control should result in a savings of at least half this loss. In addition, reducing the use of insecticides would lower the risk of meat and milk contamination. A collaborative U.S. and Australian study of exotic dungburying scarabs indicates that predation by Sisyphus sp. may be of value in controlling buffalo flies when introduced to certain infested areas in the United States.

Citrus Disease Research: Spain

Exocortis, a disease of citrus trees that causes bark scaling and dwarfing of trees, is being studied by the University of California in Riverside and the Department of Plant Protection in Valencia, Spain. U.S. scientists report good progress toward clarification of causal agents of various forms of the disease. During the second year of this 5-year project, the investigators will further define the several viroidlike causal agents of exocortis, and study the extent of dwarfing and bark scaling induced by viroids in pure form and in various combinations.

Tick-borne Cattle Disease: Mexico

The tick-borne cattle disease, babesiosis, is known to be prevalent in Northern Mexico. The potential for outbreaks of babesiosis in Texas is increasing as problems in controlling the tick vector continue. Texas A&M scientists working on an OICD collaborative research project with Mexican scientists have determined that age resistance to babesiosis favors calves. If adult cattle are among the susceptible pool, severe clinical disease and sometime death may result. Research indicates that

immunity may occur in calves before weaning and that if animals receive an initial infection before passive protection has waned, clinical illness may not occur.

Hot-boning of Pork: Federal Republic of Germany

Hot-boning of carcasses has experienced a revival in the last few years for various reasons, all primarily economic. The need for energy savings and improved meat quality have forced the meat industry to reevaluate methods used in Europe and North America before the advent of modern, refrigerated chilling facilities. Preliminary results from an OICD-supported cooperative research effort indicate the feasibility of developing hot-processing systems for pork. University of Georgia scientists collaborating with German specialists have determined that hot-boning systems offer benefits of increased processing efficiencies, lower production costs, and increased storage life of the product while maintaining high-quality characteristics.

Agricultural Marketing: Caribbean Basin Initiative

OICD coordinates USDA's educational activities in behalf of the President's Caribbean Basin Initiative. In conjunction with the Agency for International Development, OICD sponsored a third Agricultural Marketing Workshop for the Caribbean Basin as well as training programs in El Salvador, Guatemala, Honduras, and Belize. Over 700 participants attended these events including participants from 22 Caribbean countries and representatives from the U.S. public and private sectors. The purpose of these training programs was to review marketing policies and procedures, identify barriers to trade, and provide a forum for importers and exporters to become acquainted.

Cochran Agricultural Scholarship Program for Middle-Income Countries (MIC)

Since FY 1984, this training program for agriculturalists from middle-income countries has been administered by OICD. During its first 2 years, over 250 senior and midlevel managers, scientists and technicians from Algeria, Iraq, Ivory Coast, Korea, Mexico, Turkey, Venezuela, and Yugoslavia have received training in areas such as grain storage and handling, plant quarantine, poultry production, and agricultural extension. Gaining technical knowledge and experience, trainees also learn firsthand about U.S. agriculture and the free market approach to international trade.

The Forest Service (FS) research program is responsible for developing scientific and technical knowledge to enhance the economic and environmental values of America's 1.6 billion acres of forest and associated rangelands. Research is generally long range, involving biological, economic, engineering, and social disciplines.

Research is conducted through eight regional forest experiment stations and the Forest Products Laboratory at Madison, Wisconsin. More than 2,800 studies are in progress. Approximately 800 scientists are stationed at 65 locations throughout the States, Puerto Rico, and the Pacific Trust Islands.

Atmospheric Deposition Research

FS research on atmospheric deposition, expanded greatly during 1985, is designed to determine how atmospheric deposition affects forest resources and how it interacts with natural ecosystems. Research is coordinated with other member agencies participating in the National Acid Precipitation Assessment Program (NAPAP).

Results of research in 1985 include:

- A variety of natural and human-caused disturbances were found to affect the acidity of some New England ponds. In some cases it may be impossible to isolate the effects of atmospheric deposition from those other disturbances.

- A trend of increasing sulfate concentration was detected in stream water in the southern Appalachians. This may signal the beginning of a delayed response of that watershed to atmospheric deposition.

- Red spruce in the Northeast and several species of pine in the Southeast were found to be growing more slowly than expected. Atmospheric deposition is one of several factors that may be interacting to produce this result.

Forestry Competitive Research Grants Program

In 1985, for the first time, funding at $7.8 million was provided for a Forestry Competitive Research Grants program. This was done to support high risk, long-term basic research on wood materials, woody plants, and forest communities. These funds were equally divided between research on (1) harvesting, processing, and utilization, with special emphasis on chemical, mechanical, and engineering properties of wood and wood materials; and (2) basic research in forest biology, including biotechnology. The program was administered by the USDA's Competitive Research Grants Office. Every effort was made to involve all segments of the forestry community in this new program.

From the 466 submitted proposals (totaling $124.1 million) 54, or 6 percent, were selected to receive funding. The average grant was $135,000 and covered a 3-year period.

Threatened, Endangered, and Sensitive Wildlife and Fish

Some 180 wildlife and fish species in the United States are on the Federal list as actually or potentially in danger of extinction. FS research has studied habitat requirements of over 20 threatened and endangered species.

Research completed in 1985 includes:

- Development of the "Red-Cockaded Woodpecker Recovery Plan," which gives the Federal strategy for management of this endangered species.
- Development of new information on factors limiting Kirtland's warbler populations.
- A major symposium on the northern spotted owl synthesized all known information on this species.

Products from Wood Fiber

Research in papermaking technology has led to the invention of a new panel product "Spaceboard." It is made up of pulp fiber sandwich panel components that are molded in a wafflelike configuration. Two such layers are bonded together to give a sandwich board with exceptional and equal strength in both principal structural directions. The name Spaceboard is derived from the lightweight and great strength of the new material, which could have structural applications in space or in closer-to-home uses such as temporary remote shelters or emergency housing for disaster or military use.

Research to Foster International Trade

International trade in forest products has increased substantially in the last 15 years. As of 1984, the United States was both the world's largest importer of forest products ($12 billion worth) and a major exporter ($6 billion worth). Our vast forest resource base gives us the potential to transform the Nation into a net exporter of forest products.

In 1985, research was conducted in three major areas:

- Trends in international markets. Research on methods to better understand the operation of international markets.
- International trade and product sanitation. Research seeks to reduce the potential dangers of international transmission of insect and pathogenic organisms.

- International trade in forest products. FS research facilitated exports by assisting in the development of uniform product standards, utilizing a greater variety of domestic species in the manufacturing of wood export products, and tailoring new products to specific export demands.

Fire and Atmospheric Sciences Research

Research has developed a way of determining the number and locations of fire weather stations needed for a given resource management prescription. The resource managers need for weather information is translated into quantitative criteria that the computer uses to select optimum locations for fire weather stations.

Scientists have shown quantitatively, for the first time, that law enforcement reduces arson wildfires. Results of this research will help managers determine the most economically efficient level of arson law enforcement.

Forest Insect and Disease Research

The Integrated Pest Management RD&A program for bark beetles of southern pines has published comprehensive information on bark beetles and diseases affecting southern pines.

In a joint undertaking, FS scientists cooperated with the Georgia Forestry Commission to develop fusiform rust-resistant loblolly and slash pine seedlings. Preliminary tests show that incidence of rust is reduced by 40 percent in loblolly and 50 percent in slash pine, over nonresistant seedlings.

Forest Inventory and Analysis

Additional funding to support forestry surveys in 1985 has speeded the forest inventory process, resulting in a reduction in the average State cycle from 14 to 10 years, nationwide.

In a continuing effort to improve methods of projecting use patterns of forest acreages, scientists developed a land-area projection model based on proxy values that represent economic returns for different land uses. The model will allow planners and managers to evaluate alternative policies and forest management practices based on various projections.

Renewable Resources Economics Research

Economic models were used to estimate values per trip, per calendar day, and per user day for many fish and wildlife species sought by recreational hunters and anglers in Idaho. Resulting dollar-value estimates measure their willingness to pay for outdoor experiences over and above their actual cash expenditures. Such measures are badly needed for making resource management decisions that meet societal needs most efficiently.

Trees and Timber Management Research

The use of biotechnology to grow superior forest trees is rapidly becoming feasible. Scientists have successfully transferred genetic information from a common bacterium into loblolly pine. This result will make possible to transfer genes derived from other plants or genes created in the laboratory into most commercial tree species.

To help northern hardwood forests achieve their economic and ecologic potential, FS silviculturalists gathered together all past research on northern hardwoods and published the results in 48 notes, which cover all aspects of management from insect and disease control to regeneration methods. These Northern Hardwood Notes are available in loose-leaf form from the Superintendent of Documents.

Watershed Management and Rehabilitation Research

Researchers have developed a technique that uses information from aerial photographs to determine the relationship between physical structure of stream channels and upstream logging activity in the Pacific Northwest. The technique gives forest managers a rapid and inexpensive way to compare watersheds that have different characteristics with alternative management treatments to evaluate resulting changes in watershed condition.

Scientists found that sometimes erosion processes must continue before a landscape can be stabilized. Research on the Alkali Creek Watershed in western Colorado showed that erosion of steep soil banks with high sodium content and subsequent leaching of the sodium from the material deposited in the channel bottom were the key factors in stabilizing the watershed.

Wildlife, Range, and Fish Habitat Research

FS collaborated in preparing copy for a recent book, "White-Tailed Deer: Ecology and Management," published by the Wildlife Management Institute. It is the most comprehensive treatment of this species ever published. It covers deer biology and ecology, population management, habitat management, research, benefits, and management needs and opportunities.

The Apache trout is a rare trout in the West, limited to a few cool mountain streams in east-central Arizona. The trout's existence is threatened by habitat destruction, displacement by other species, and hybridization. Scientists have completed an extensive taxonomic survey of remaining trout strongholds. Study results will be used by the Apache Trout Interagency Recovery Team to help prevent loss of this unique fish.

Forest Recreation Research

FS developed "Limits of Acceptable Change" (LAC) approach which is a method to determine the maximum number of recreational visits a wilderness area can sustain without suffering physical damage or reduction in the quality of user experience. LAC defines the amount of change to be allowed,

identifies management actions needed to prevent further change, and gives procedures to monitor and evaluate management performance.

A study of how people reacted to various tree densities in two parks in the Chicago suburbs showed that most park users preferred tree densities of 50 to 65 per acre. This information can be used to guide urban tree replacement programs.

Forest Products and Harvesting Research

A land management analytical technique has been developed to identify slopes that have high potential for landslides. The technique also provides alternative approaches to avoid or stabilize these areas. The method has been adapted for field application through use of hand-held programmable calculators.

FS research has shown that carbohydrate derivatives can replace up to 50 percent of the components in phenolic adhesives now used to bond wood-based panel products such as plywood. Easily obtained from wood, from byproducts of wood manufacturing, or from other renewable biomass sources, carbohydrate derivatives can significantly reduce the use of petroleum-derived resins.

International Forestry

Our International Forestry program (IF) provides leadership, coordination, and direction for FS involvement in forestry worldwide.

Examples of 1985 accomplishments include:

- Leadership and staff support was provided to new bilateral agreements for forestry cooperation with other countries, most notably with the Soviet Union and Mexico.

- Cooperative research was undertaken with 6 countries on 25 projects, and 15 scientific exchanges took place with 6 countries. Of particular benefit were the acquisition of new tree germplasm and information on atmospheric deposition.

- IF played an important role in redrafting and completing the Program for Tropical Forestry in Latin America and the Caribbean.

- Practical training programs were provided at various FS units for over 65 international visitors from 33 countries.

Another important aspect of the IF program is the work done through the Forestry Support Program--a joint effort by the FS and the U.S. Agency for International Development (USAID). In 1985, the Forestry Support Program helped create three new programs to strengthen linkages with developing countries. These programs were (1) an agreement between USAID's Office of

Foreign Disaster Assistance and USDA, (2) an agreement between USAID and USDA for technical assistance and development of long-term institutional linkages with Mexico, and (3) a new Forestry Technical Adviser position in the Caribbean island region, cost-shared with USAID.

FEDERAL GRAIN INSPECTION SERVICE (FGIS)

The Federal Grain Inspection Service (FGIS), in the process of fulfillment of its mandate to administer the Nation's grain inspection and weighing system, conducts applied research. FGIS is an action-oriented agency with responsibilities for applied research in development of new or improved methods and equipment for grading, inspection, and weighing of grain; inspection standards; inspection and weighing procedures; and other grain-marketing services and programs. FGIS has the need for supportive basic research to solve problems and improve the efficiency of its inspection and weighing activities. FGIS and ARS, USDA, have executed a Memorandum of Agreement that establishes policies, responsibilities, and procedures concerning the development and application of science and technology in the field of grain marketing. The director, Standardization Division, shares with the administrator ultimate responsibility for overall planning, research, standards development, and related support programs and activities assigned to FGIS.

Research involving FGIS is carried out (1) in-house and (2) by reimbursable agreement with ARS or contract through APHIS. Projects for which the manpower and equipment are available or reasonably obtainable are handled in-house.

Grain-Moisture Measurement

The investigation of alternative moisture determination procedures for grain, both reference are field procedures. Vacuum oven, Karl-Fischer Titration, and Nuclear Magnetic Resonance procedures are being evaluated. New electronic meters are being evaluated. For instance, a microwave transmittance meter is being tested and a new dielectric meter, designed to be more accurate over wide ranges of grain moisture than presently available meters, is being developed.

Measurement of Protein and Oil in Soybeans

Investigations intended to take better advantage of existing near infrared reflectance (NIR) technology are being pursued. New and improved technology in this field is being pursued in the form of making use of NIR technology for protein and oil determination in soybeans. The procedures are well known but preparing them for possible introduction into the inspection system requires considerable refinement.

Measurement of Oil in Sunflower Seeds

Nuclear magnetic resonance (NMR) was introduced into the inspection system as a rapid procedure for measuring oil content of sunflower.

Measurement of Oil and Free Fatty Acid in Rice

Determining the degree of rice milling by an objective NIR examination is being researched, as well as collaborative studies on the oil and free fatty acid content of brewers' rice.

Equipment Evaluation	Improvement and/or evaluation of and for the Carter-Dockage Tester are researched on an ongoing basis.
New Inspection Equipment	New equipment for use in the inspection system in the form of an automatic three-way divider and an automatic bleaching apparatus for damage detection in sorghum are being developed. A system for the semiquantitative evaluation of aflatoxin in corn was placed in the inspection system.
Wheat Hardness	The investigation of new wheat classification procedures is a high-priority project. Hardness determination on a single-kernel basis has been researched and prototype equipment developed by ARS. Evaluating this equipment was started.
Detection of Foreign Odors in Grain	A commercial research firm is developing instruments to detect and identify foreign odors in grain; a procedure that requires the use of sophisticated analytical equipment as the constituents of "odor" are many and varied and may be in low concentration. If successful, this work would eliminate the sniff test by a human nose and eliminate some inherent hazards with the old procedure. The project is in the prototype stage.
Foreign Material Determination	A midwestern university is evaluating the many different procedures used around the world to determine foreign material in grain. A recommendation will be made as to the two best procedures. FGIS will then decide on further action.
Toxic Seeds	ARS at Albany, California, is investigating the toxicity of five commonly appearing weed seeds that may, under certain conditions, be mixed with grain for human consumption. The knowledge of the toxicity of these seeds is presently vague; the project should produce definite information as to toxicity levels in these weed seeds.
Detection of Hidden Infestation	In another ARS-FGIS project, the possibility of the use of computer-enhanced x-ray imaging of internal insect infestation in wheat is being investigated. The x ray has been in use for many years but not with the specificity hoped for from this procedure. The original idea for the project came from work ARS did for APHIS in developing x-ray imaging for use on suitcases arriving from foreign origins.
Measurement of Moisture Blends of Corn	ARS in Athens, Georgia, is researching the use of microwave technology to determine moisture in corn, a kernel at a time. The completion of this project would enable the inspection system to detect the moisture range of high- and low-moisture corn in the lot and possibly estimate the keeping quality of the grain while in transit.

Diverter Sampler Evaluation	The proper diverter opening for diverter-type samplers when sampling sunflower is being investigated by a private company under contract with FGIS.
Corn Breakage Instrumentation	A research project has been proposed to study the susceptibility of corn to breakage in the laboratory with an instrument. This process should approximate corn breakage during shipment.
Accuracy of Probe Sampling Insect Infested Grain	A proposed project is to determine the accuracy of the probe sampler in depicting the actual number of live insects in a given lot of grain.

The Cooperative Extension System (CES) is a three-way partnership consisting of the USDA Extension Service and the Cooperative Extensive Services in each State and territory at the land-grant colleges and universities and local offices in nearly all the counties. The basic mission of the CES is to disseminate and encourage the application of research-based knowledge to improve American agriculture, conserve natural resources, strengthen family and community life, and develop leadership capabilities in adults and youth across the country. The Federal partner provides support for the State counterparts by overseeing distribution of Federal funds, reviewing CES programs, and informing States about Federal priorities and programs. The CES provides information, material, and advice in agriculture, natural resources and rural development, home economics and human nutrition, 4-H and youth development, and related administrative, EEO, and information areas both in this Nation and abroad.

Farmers in Crisis Aided

During the past 2 years, Extension has helped 95,600 farm families develop a revised farm business and financial plan. Nearly half these families will continue to farm full-time, 8 percent will leave the farm, and 24 percent will farm part-time with off-farm income. In the next 12 months, 260,000 more farm families will need such help, and about two-thirds of those already aided will need help in 1986.

Hotlines are provided by 12 States with about 18,000 calls to date; 14 States have counseling centers. Extension programs provided information to 167,000 farm families on family stress. About 15,600 agricultural professionals received indepth training in how to provide intensive assistance to farm families, and these people helped 80,000 farm families in the last 2 years. About 8,000 rural nonfarm businesses and community organizations received intensive assistance in the financial planning from Extension.

Family Security Assured During Crisis

Extension home economics programs in 31 States helped 64,702 families in handling problems due to the farm financial crisis. Over 26 million families were reached directly or through Extension-generated media contacts. Also, about 1.7 million people took part in financial planning and management programs.

Conservation Tillage Taught

Significant Extension conservation tillage programs in 1985 include: Indiana Extension, aided by Soil Conservation Service and Soil and Water Conservation Districts, held 10 regional seminars on conservation tillage in which over 2,000 farmers and agribusiness leaders participated. Over 5,000 Kentucky farmers attended 27 Extension no-till conference emphasizing conservation tillage.

Trade Education Expanded	Extension has expanded its programs to provide information on trade and trade policies to farmers, agribusiness managers, local public officials, and homemakers. These programs are designed to create awareness and understanding of trade policies and their implications for farm and business enterprises. In March 1985, a televideo conference from Oklahoma State University reached over 3,000 educators, Extension economists, business operators, and government officials at 50 downlink sites around the country.
Profitability Aided by IPM	Integrated pest management (IPM) contributes to Extension efforts to increase agricultural profitability with production cost savings ranging from $27 to $60 per acre and yield increases between 5 and 20 percent in several States.
Ground-Water Contamination Addressed	The Wisconsin Extension Pesticide Impact Assessment Program involves work with research and regulatory agencies in obtaining data to define and evaluate benefits and risks of selected pesticides. Changes in pesticide use patterns and impacts of these are monitored. New application procedures for aldicarb were developed that retained insecticide benefits while reducing leaching potential.
Nutrition Education Provided	Louisiana's food, nutrition, and health programs improved dietary practices of 175,000 participants. Most States employ user-friendly computer programs to analyze and evaluate clients' dietary practices. About 4,000 people in 20 Maryland counties had their diets evaluated through such programs and received education on diet modification.
Avian Influenza Information Provided	Extension staff worked with Animal and Plant Health Inspection Service and State regulatory officials in Pennsylvania, Maryland, Virginia, and New Jersey to educate the poultry industry and alert them to potential spread of avian influenza. Extension's massive response improved the communication network among Extension personnel, State and Federal agencies, and all parts of the poultry industry. Avian influenza was eradicated and heavy losses of hundreds of millions of dollars were averted.
Teen Distress Documented	A study by 4-H agents in southwestern Minnesota study on teen suicidal thought and attempts found the suicide attempt rate reported to be 300% larger than expected. Partly because of this study, 4-H programs will be modified to increase coping skills of youth and families.
EFNEP Educates Needy Families	About 235,000 homemakers, representing nearly 895,000 family members, and almost 455,000 youth participated in Extended Food and Nutrition Education Program (EFNEP). Just over 4,000 Extension paraprofessionals and over 53,500 volunteers contributed to EFNEP delivery. Extension staff refers families

	to other nutrition programs, where appropriate, and enrolls and teaches the most needy families, most of whom put into practice healthy dietary changes.
Eastern Hardwoods Used	Market potential for Eastern hardwoods improved as North Carolina Extension and others conducted workshops on producing and using framing lumber from yellow poplar, aspen, and other less dense hardwoods.
Aquaculture Efforts Expanded	In many Southern States the catfish industry continues to grow and provide industry stability while crawfish production also expands. Extension educational programs have contributed directly to this substantial growth. Income to the fish farmer/producer for trout and catfish for processing exceeded $150 million in 1983.
Community Priorities Determined	Extension's community and rural development program helps communities involve citizens in identifying priority needs and developing group action to address those needs. Georgia studies improved solid waste management systems and sanitary landfills in several counties. Extension assisted over 1,200 community projects in Kentucky (including crime prevention, drug education, and fire protection). Mississippi's program provides feasibility guides and technical assistance in water and sewer facility planning, community beautification, and volunteer fire department organization.
Youth Leadership Developed	Program activities range from Citizenship Shortcourses in Washington, D.C., to coordinating conferences in State capitals where 4-H'ers function as legislators, lobbyists, and reporters. In Florida, 4-H'ers participate in model legislature sessions, roll-call votes, and other situations. In California, Sacramento's 4-H members simulate the legislature and also study State geography, history, cultures, industries, and government operations. This program is modeled after the training held each summer at the National 4-H Center sponsored by USDA's Extension Service and the National 4-H Council.
Rural Retail Trade Improved	Iowa Extension's retail trade program has encouraged 660 new businesses (3,185 new jobs) in the past 5 years, with 83 vacant stores filled and 50 retail strategy groups formed. For 32 of the towns participating, retail sales rose $98 million over 3 years. Fifty-four towns not participating lost $245 million during the same period.
Local Government Capacity Being Built	Iowa Extension is helping local governments handle fiscal responsibilities under Federal decentralization. Officials from nearly 1,000 cities and towns are being trained in financial management, decisionmaking, and recordkeeping.

Research Described in Data Base	With the Agricultural Research Service, Extension Service has developed a Research Results Data Base. It contains 1-page descriptions of over 2,000 recent ARS research discoveries, which State Extension staff can access by computer terminals.

The National Agricultural Library (NAL), with a collection of 1.8 million volumes, is the largest agricultural library in the free world. It collects technical information on agriculture and related subjects from all over the world and makes it available with the use of computer data bases to scientists, educators, and farmers. The library is the coordinator and primary resource for a national network of State land-grant and field libraries. It serves as the U.S. center for the international agricultural information system.

New Specialized Information Centers

With the provision of expanded resources by the U.S. Congress, the National Agricultural Library created five new specialized information centers focusing on major agricultural topics--aquaculture, biotechnology, critical agricultural materials, food irradiation, and horticulture. Topics were determined by several factors including Congressional mandate, priorities within the U.S. Department of Agriculture (USDA), availability of subject expertise on the library staff, and financial support or interest by agricultural trade and professional organizations. Additional centers on alternative farming systems and fibers were planned.

Laser Disk for Land-Grant Libraries

A second laser videodisk for the storage and retrieval of full-text agricultural information was initiated based on the success of an evaluation study of laser technology involving the "Pork Industry Handbook" produced by the Extension Service. The new disk, containing the full text and associated graphics for 13 USDA publications, will be offered free to land-grant libraries who have, or are willing to procure, the necessary hardware and software to utilize the new storage medium.

Forestry Photo Collection

The Forest Service historical photo collection consisting of over 500,000 photos and several thousand slides--the largest of its kind in the world--was acquired by the NAL together with the FS permanent image database, an online index to the collection. Negatives of the collection materials are housed at the National Archives and prints can be ordered from that institution. As part of the transfer agreement, the library will do a pilot study on the use of laser technology for storage and access to a portion of the collection.

Illinois in Document Delivery System

The University of Illinois became the 36th State and the eighth region to join the Regional Document Delivery System (RDDS), a network partnership of NAL and the States providing document delivery services at the local level to USDA field personnel located in the States. USDA document delivery requests not fillable by the cooperating land-grant library are referred through a regional coordinating library where they are filled or referred to NAL which serves as a provider of last resort.

Veterinary Science Pact with NLM	An agreement was reached with the National Library of Medicine (NLM) to cooperate in allocating collection development responsibilities regarding various fields of veterinary science. The understanding involved commitments on acquisitions, processing priorities, availability of materials, and preservation of materials for future needs. Discussions were also held with other institutions exploring the possibilities of similar cooperative efforts to minimize unnecessary duplication of effort and to allow for the redirection of resources to areas of greater need.
Microcomputer Software Demo Center	A national demonstration center for food and nutrition microcomputer software was established at the library with an initial collection of over 70 food and nutrition programs. People from all over the Nation visited the center for demonstrations and hands-on experience with the various programs. Software producers donated demonstration disks or copies of their programs with full documentation for inclusion into the AGRICOLA database as well as for the use of patrons of the NAL Food and Nutrition Information Center.
Electronic Document Delivery Network for Regions	The feasibility and acceptability of using electronic telecommunication techniques for document delivery within a network was the subject of a new study involving the regional research center libraries of the Agricultural Research Service. In this telefacsimile project, the center libraries were linked with the NAL, their own State land-grant library, and other appropriate libraries serving the center library. The system was designed to enable the center library to supply a much higher proportion of documents requested by scientists at those centers than they now do and to do so much more quickly.
Feed Composition Data Bank	The Feed Composition Data Bank (FCDB), containing information on more than 23,000 feedstuffs from around the world, became operational at NAL after being transferred from Utah State University. The FCDB exchanges feed composition information within the International Network of Feed Information Centers (INFIC), and since its transfer, it has grown rapidly through utilizing the extensive collection of research papers available at the library. The data bank included an International Feed Names File and a data file containing information on the nutrient value of animal feedstuffs.

DEPARTMENTAL OBJECTIVES

Several of the top 16 USDA objectives for the future, as determined at the Secretary's Top Staff Conference in July 1982, are directly related to the food and agricultural sciences. These include:

Help Farmers Market Their Products

Research and education agencies will improve the knowledge and information bases available to agricultural producers concerning presently available marketing alternatives; identify opportunities for developing new marketing alternatives; provide information, training, and technical assistance to producers that will improve their marketing skills, practices, and strategies.

New Products

Develop a research program that will provide the technology needed to produce new agricultural and forestry crops to meet national needs; provide for crops for arid lands, problem soils, strip-mined areas, and family farms; and develop new crops that will supply new medicinals, gums, waxes, resins, oils, proteins, hydrocarbons, and fibers for industrial use and new crops to replace crops in chronic surplus.

Increased Efficiency

Conduct fundamental research on the physical and biological aspects of agricultural and forest products and the processes by which they can be preserved, converted into safe and useful products, and transported from producer to consumer; conduct economic research on costs and efficiency in the marketing system, and the economic performance of markets for agricultural and forest products; and provide for the extension of technology and market intelligence to producers, marketers, and consumers.

NATIONAL PRIORITIES RECOMMENDED BY THE JOINT COUNCIL ON FOOD AND AGRICULTURAL SCIENCES

In May 1985, the Joint Council identified five major priorities for FY 1987 science and education programs. The Joint Council recognizes the importance of strong base programs in research, extension, and teaching and urges the continuance of support for these programs. Those priorities selected for special emphasis are particularly appropriate because of specific problems now facing agriculture and/or because of opportunities for important advances in these areas.

Increase Agricultural Profitability Through Management

Profitability has always been an important component of U.S. agricultural and forestry enterprises. To help the producers of food and fiber cope with the current difficult economic climate, the science and education system needs to develop multidisciplinary research and education programs focused on increasing farm and forest profitability. Attention should be directed to optimizing profits through better integration of production, management, and marketing strategies, including new uses for farm products, and to developing realistic family and business goals. Agricultural producers who face critical operating decisions need help in evaluating available alternatives. Producers also need assistance in developing management systems, including control and management of plant and animal pests and diseases, that will use human resources efficiently and produce maximum profit. Low-cost, efficient production systems will help U.S. agriculture remain competitive in world markets.

Improve Water Quality and Management

Protecting water resources and using them efficiently continue to be important concerns for agriculture and forestry. Natural sources of water are being threatened by toxic chemicals and atmospheric pollutants. In the arid West there is a need to utilize water supplies more efficiently through the application of feasible watershed management practices. Improved irrigation efficiencies can reduce both energy requirements and the importation of waterborne salt. Attention should be directed to assessing the impact of soil, water, and atmospheric pollutants on livestock and crops and to improving the understanding by public officials and citizens about the nature of water resources. There is a need for increased understanding of relationships between crop production systems and the quality of ground and surface waters.

Expand Biotechnology Efforts on Plants, Animals, and Microbes

Through biotechnology, plants, animals, and microbes can be improved or modified to enhance their benefits to society. Recent innovations in genetic engineering techniques hold great promise for revolutionizing agriculture, forestry, microbiology, biology, and medicine. Molecular geneticists and conventional plant breeders are highly dependent upon a resource of genetic diversity, which must be assembled, maintained, and made readily accessible through an efficient system to develop the unique, productive organisms necessary for a stable,

plentiful, and high-quality supply of food, feed, fiber, and forest products, and for the development of new uses for these products. Research should be expanded on transfer, expression, and regulation of individual genes and gene systems and on acquiring and conserving the maximum range of genetic diversity by appropriate sampling, collection, and preservation procedures.

Develop Necessary Scientific and Professional Human Capital

Today's American agriculture is a high-technology industry characterized by rapid and continual changes in methods of production, large investments in research, and an ongoing need for a highly qualified cadre of scientists and professionals to meet increasing demands for food and agricultural products. To achieve the goals necessary to meet projected needs, immediate action must be taken to increase the development of scientific and professional human capital. Steps which will enhance this activity are expansion of predoctoral and postdoctoral fellowship programs, development of a national, computerized, higher education information system, implementation of faculty revitalization programs, and strengthening of curriculums.

Improve Human Nutrition and Understanding of Diet/Health Relationships

Today's consumers are bombarded with nutrition advice from many sources. Some of this advice is unreliable, expensive, and not in keeping with the recommendations of nutrition scientists. Abundant production alone, without attention to quality factors, is not sufficient to assure consumer acceptance of products and adequate returns to farmers. Better linkage is needed between plant and animal production/processing as they relate to human nutrition requirements. More emphasis should be directed to determining human nutrient requirements under both normal and stressful conditions and their relation to long-term health factors. Improved technology to prevent, detect, and remove natural and environmental toxins and pathogens from food products is also needed. Consumers must be educated about problems faced by agricultural producers, and producers must be informed about desires of consumers for food products that enhance nutritional well-being.

Other Topics Considered

The Joint Council also discussed several other important priorities. They included sustaining soil productivity; improving forest and range productivity; encouraging energy conservation; enhancing efficiency of agronomic and horticultural crop production; collecting, preserving, evaluating, and enhancing germplasm; reducing impacts of pests on plants; reducing impacts of atmospheric deposition and water pollutants on plants; augmenting livestock and poultry production efficiency; improving management of animal diseases and pests; and increasing aquatic food production.

Other priority items considered were improving food quality and safety, improving family financial management, encouraging home

horticulture, improving agricultural policy analysis, improving economic information on U.S. agricultural trade, expanding domestic and international markets for agriculture and forest products, expanding use of electronic communications/computer systems, increasing public education on agriculture, and developing volunteer leadership.

PRIORITIES OF THE NATIONAL AGRICULTURAL RESEARCH AND EXTENSION USERS ADVISORY BOARD

- Profitability
- Preserving the Environment
- Biotechnology
- Higher Education
- Human Nutrition

United States Department of Agriculture

Agricultural Research Service

Office of the Administrator

Washington, D.C. 20250

October 3, 1986

SUBJECT: 1985 Annual Report on the Food and Agricultural Sciences

TO: USDA Research and Education (R&E) Committee

FROM: James T. Hall, Executive Secretary
R&E Committee

Enclosed is a copy of the "1985 Annual Report on the Food and Agricultural Sciences from the Secretary of Agriculture to the President and the Congress of the United States." This annual report is required under Section 1410 of the Food and Agriculture Act of 1977, Title XIV of the Agricultural Act of 1981, and Title XIV of the Food Security Act of 1985.

It was prepared under the auspices of the R&E Executive Committee with the assistance of 13 USDA agencies. Representatives of these agencies who assisted me in the preparation of the report are as follows:

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Bruce Greenshields, ERS
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Special recognition is given to Kay McDonald, ARS, who assisted in editing and arranged for the printing of the report, and to Rachel Mauser, ARS, who oversaw preparation of the final draft and distribution of the printed report.

Enclosure

cc:
O. G. Bentley
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